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GEOTECHNICAL EVALUATION
PROPOSED CANYON VILLAS AT THE WELK RESORT
TM 5313/REZ 03-004/S03-029/ER79-08-099A/ZAP08-010
ER 79-08-099A/SCH #2003071108
WELK VIEW DRIVE
ESCONDIDO, CALIFORNIA

PREPARED FOR:
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CTE JOB NOS. 10-6305 & 10-6349

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1.0 EXECUTIVE SUMMARY

This geotechnical investigation was performed to evaluate geotechnical aspects of the proposed Canyon Villas development at the Lawrence Welk Resort in Escondido, California. Potential geologic hazards to the site such as rockfall, slope stability, liquefaction and seismicity can be readily addressed by standard grading and construction project design features. Additional evaluation of the site should be performed to provide geotechnical engineering recommendations for project design and construction as site development plans are finalized.

The site will be developed by cut and fill grading to support two, two- and three-story buildings, and associated parking/drive, landscaping, and retaining wall improvements. The two, two- and three-story buildings will have one level of underground parking/basement improvements and consists of transient habitation units.

Based on our geotechnical evaluation, soils beneath the site consist of Undocumented Fills/Topsoil and Quaternary Alluvium/Colluvium overlying Cretaceous "Granitic" bedrock. Groundwater was not observed at this site. However, during seasonal weather changes, areas of local saturation and seepage may be encountered. From a review of preliminary project plans, CTE does not anticipate that groundwater will affect the proposed development, provided surface drainage is maintained. Based on the geologic findings and reference review, no active surface faults are known to trend through or project toward the site. This geotechnical evaluation indicates proposed cut and fill slopes would be stable as planned.

This report should be considered in its entirety. This Executive Summary should not be considered a "stand alone" source for project geotechnical considerations.

2.0 INTRODUCTION AND SCOPE OF SERVICES

2.1 Introduction

Construction Testing and Engineering, Incorporated ("CTE") has prepared this report for the proposed development at the Lawrence Welk Resort in Escondido, California. Figure 1 is a map showing the general location of the site.

2.2 Scope of Services

The scope of services include:

- Review of readily available geologic reports pertinent to the site and adjacent areas (Appendix A contains a list of cited references);
- Assessment of the general geology and evaluation of potential geologic hazards at the site;
- Performing a rockfall evaluation;
- Performing a rippability assessment using seismic refraction equipment;
- Slope stability evaluation; and,
- Preparation of this report providing investigations performed, and conclusions and recommendations concerning geotechnical aspects of project development.

3.0 BACKGROUND AND PROJECT DESCRIPTION

3.1 Site Location and Description

The site is located approximately ¼ miles east of Interstate Highway 15, at the northeast corner of the intersection of Champagne Boulevard and Welk View Drive in the Lawrence Welk Resort. San Diego County Assessor's Parcel numbers for the site are 172-092-03, 172-092-11, 185-363-08, and 185-363-20. These are identified as Lots 1 and 2 (Figure 2).

The site is an irregular-shaped parcel with sloping and irregular topography. The general site topography slopes down to the west, toward Champagne Drive. Site elevations range from approximately 485 feet above mean sea level (msl) on the west side (Lot 1) to approximately 900 feet msl at the east side (Lot 2). Appendix B includes a copy of the proposed preliminary grading plan showing the existing site topography.

The Canyon Villas at the Welk Resort are cumulatively divided as Lot 1 and Lot 2. The west approximate one-third of Lot 1 consists of a open space as a flowage easement for north flowing storm water. The central portion of Lot 1 includes a graded pad locally surfaced with asphalt and gravel for vehicle parking and maintenance equipment including construction trailers. The east approximate one-third of Lot 1 consists of a graded pad to support a single story resort style office building and paved parking that is bounded on the east by a west facing graded slope rising to a natural slope. Lot 2 predominantly consists of a natural west facing slope. The lower approximate one third of Lot 2 includes overgrown and degraded cut and fill pioneer roads, and remnants of a water reservoir system.

Land near the site is used for of a mix of commercial and residential purposes. The south side of the site is bounded by Welk View Drive. Welk Resort properties, golf course, and associated improvements are located to the south of Welk View Drive. Land to the north of the site is used by a commercial winery business or is open-space. Land to the east of the site is designated as open-space. Champagne Boulevard bounds the west margin of the site with undeveloped property and

Interstate 15 further to the west. Figure 2 is an aerial photograph showing the general site configuration. Figure 3 shows a generalized cross section of the site.

3.2 Proposed Improvements

CTE understands the proposed improvements include mass grading of two building pads on Lot 1 and the subsequent construction of two, two- and three- story, *transient habitation* buildings (Buildings A and B) with underground parking. Additional improvements include construction of associated drive/parking and landscaping areas. A retaining wall is proposed at the southeast corner of the site. CTE also understands the existing building and other improvements will be demolished and/or removed. The west approximate one third of Lot 1 is a flowage easement and will remain as open space. Appendix B includes a copy of the proposed preliminary grading plan showing the proposed improvements and site layout.

3.3 Field Investigations

Field investigations at this site, performed in May and July 2003, September 2007 and February 2009, included site reconnaissance and observation of soils exposed at the surface, seismic refraction surveys, subsurface exploration by backhoe, and observation of boulders exposed at the ground surface. Exposed soils were visually classified by a CTE geologist using the Unified Soil Classification System. Observations were performed in Lot 2 (open space) area to assess the potential for rockfall hazards. Additionally, four backhoe test pits and geophysical survey were placed at the east proposed cut on September 20, 2007. Appendix C contains photographs documenting site conditions.

3.4 Previous Investigations

Geotechnical investigations were performed in the site area by Vinje & Middleton Engineering, Inc. (VME). Subsurface exploration and geotechnical reports were performed by VME (1999 a, b, c) prior to construction of Phase I, II, and III of the Villas on the Green project. Environmental impact studies were performed by RBF Consulting (2003) at the Welk Garden Villas project, located east of the subject site. Information from those was referenced for preparation of this report.

3.5 Project Design Measures

Project design measures are recommended with regard to potential rockfall hazard at the site. Methodology for identifying potential rock fall hazards are presented in Section 5.6. Project design measures are recommended in Section 5.7 of this report as pertaining to potential rockfall hazard. The recommended project design measures include restraining boulders in place, size reduction and shaping of spalled isolated and grouped boulders, construction of a low cofferdam at the toe of selected boulders, shallow embedment of boulders, and/or mechanical/chemical fracturing of boulders with embedment of particles. Additionally, a top of cut slope low height steel rail/cable and post structure is recommended to restrain cobbles. The top of cut slope structure would be up to three feet high with approximately eight inches of ground clearance.

4.0 GEOLOGY

4.1 General Physiographic Setting

The site lies within the northeastern inland area of San Diego County. Geomorphically, this area is recognized as forming the foothills of the Peninsular Ranges. Terrain locally consists of alluvial valleys between crystalline bedrock hills.

4.2 Geologic Conditions

Based on our observations and previous investigations in the site area (VME, 1999a, b, c), site materials consist of Topsoil, Undocumented Fill, Quaternary Alluvium/Colluvium, and Cretaceous "granitic" bedrock. Figure 3 is a cross-section of anticipated geologic conditions at this site. Cross section location and surficial geology are shown on Figure 4. Attached Appendix D provides additional geologic data and presents revised geologic areas sections and map.

4.2.1 Topsoil and Undocumented Fill

Topsoil (not mapped) and Undocumented Fill soils were observed across the site. These materials consist dominantly of loose to dense, dry to moist, tan to brown, silty sand.

4.2.2 Quaternary Alluvium/Colluvium

Alluvium/Colluvium were observed at the east and west sides of the site, respectively. These materials generally consist of silty sand to gravelly sand. Similar conditions were observed by VME (1999a,b,c) during previous geotechnical investigations in the vicinity of the site.

4.2.3 Weathered "Granitic" Rock

Weathered "granitic" rock of the Peninsular Ranges Batholith was encountered in cut slopes and outcrops at the eastern half of the site. In addition, "granitic" rock was observed in subsurface investigations by VME (1999a,b,c) and was reported by RBF Consulting (2003) in the vicinity of the site. Numerous "granitic" boulders are located throughout the site and along the hillside of Lot 2.

4.3 Groundwater Conditions

Groundwater was not encountered during our observations at the site or during investigations by VME (1999a). Although groundwater levels may fluctuate, groundwater is not expected to affect the proposed improvements if drainage is maintained. However, seasonally variable and local saturated/seepage conditions could affect construction during the wet seasons, especially near the west drainage easement.

4.4 Geologic Hazards

From CTE's investigation it appears geologic hazards at the site are primarily limited to those caused by shaking from earthquake generated ground motion waves. The potential for damage from displacement or fault movement beneath the proposed structures is low. The site is not within a State of California-designated Alquist-Priolo Special Studies Zone for earthquake faults.

4.4.1 Local and Regional Faulting

Based on site reconnaissance, evidence from subsurface explorations, and review of available geologic literature, it is the opinion of CTE the site is not underlain by or within the projection of known active fault traces. According to the California Division of Mines and Geology, a fault is active if it displays evidence of activity in the last 11,000 years (Hart and Bryant, 1997).

The Elsinore Fault Zone, approximately 12 miles to the east, is the closest known active fault (Jennings, 1987) to the site. Other principal active regional faults in the vicinity of the site include: the Rose Canyon, Coronado Banks, San Jacinto, Palos Verdes, San Andreas and Newport-Inglewood Faults.

4.4.2 Site Near Source Factors and Seismic Coefficients

In accordance with the California Building Code 2001 edition, Volume 2, Figure 16-2, the referenced site is located within seismic zone 4 and has a seismic zone factor of Z=0.4. The nearest known active fault in the Elsinore Fault Zone, is approximately 12 miles to the east and is considered a Type A seismic source. Based on the distance from the site to the Elsinore Fault Zone, near source factors of N_V=1.0 and N_a=1.0 are appropriate. Based on the shallow subsurface explorations (VME, 1999a) and our knowledge of the area, the site has a soil profile type of S_B and seismic coefficients of C_V=0.40 and C_a=0.40. Seismic factors should be updated during the final design phase to take into account State of California design values at the time of development.

4.4.3 Tsunami and Seiche Damage

The potential for tsunami damage at the site is negligible due to the site's elevation (greater than 100 feet above sea level) and distance from the ocean. Damage caused by oscillatory waves (seiche) is considered unlikely, as the site is not near substantial water bodies that could reasonably be expected to affect the site.

4.4.4 Landslides or Rockslides

A discussion of landslide and rockslide hazards is presented in Section 5 and Appendix D of this report. CTE anticipates the potential for landsliding to affect the site during its design life is low. Project design measures are recommended to reduce the potential for rock fall hazard.

4.4.5 Compressible and Expansive Soils

Based on geologic observation of Topsoil, Undocumented Fill and Quaternary Alluvium/Colluvium, there is a potential site soils may be locally expansive and exhibit compressible characteristics. These materials are likely unsuitable for support of compacted fill and improvements in their present condition. Standard grading and design measures are recommended to address potential expansive and compressible on site soils. These typical design measures include overexcavation and compaction of soil, and foundation reinforcement.

4.4.6 Liquefaction Evaluation And Seismic Settlement Evaluation

Liquefaction occurs where saturated fine-grained sands or silts lose their physical strength during earthquake-induced shaking and behave as a liquid. This is due to loss of point-to-point grain contact and transfer of normal stress to the pore water. Liquefaction potential varies with groundwater level, soil type, material gradation, relative density, and intensity and duration of ground shaking. Seismic settlement occurs where loose to medium dense granular soils densify during seismic events.

The liquefaction and seismic settlement potential of the site is anticipated to be low due to the interpreted shallow depth to underlying very dense granitic materials. However, soft alluvial materials along the west side of the site may be subject to localized liquefaction and/or seismic settlement depending upon depth to groundwater and physical characteristic of underlying soil deposits. Liquefaction of loose or soft surficial soils (Topsoil, Undocumented Fill and Alluvium/Colluvium) can be precluded by standard soil processing and compaction during site grading. However, deep sandy alluvial materials, if present below the groundwater surface along the western side of the site, may be susceptible to liquefaction and/or seismic settlement. Liquefaction potential in areas to support improvements can be reduced via standard construction techniques such as deep overexcavation and compaction. Therefore, in the opinion of CTE, the existence and effects liquefaction and/or seismic settlement are precluded by previously mentioned standard project design measures.

5.0 SLOPE STABILITY EVALUATION

5.1 Field Investigations

Slope stability field investigations to evaluate potential landslide and rockfall hazards at this site, performed June 20 through June 26, 2003 and February 24, 2009, included site reconnaissance, mapping of soils and rock outcrops exposed at the surface, measurement of bedrock joint attitudes, and photographic documentation. Boulders were surveyed by Hale Engineering, Inc. and added to the topographic site map, including latitude and longitude location, as shown on Figure 5. Exposed soils were field classified by a CTE geologist using the Unified Soil Classification System. The field investigation included an evaluation of landslide and rockfall hazard potential on the approximate east one fourth portion of Lot 1 and Lot 2 as it ascends to its east ridgeline.

5.2 County of San Diego Landslide and Rockfall Hazards

5.2.1 County of San Diego Landslide Hazards

Landslides have occurred in "granitic" bedrock areas in the County of San Diego. Landslides generally have one or more distinct failure surfaces (Rahn, 1996). In "granitic" bedrock, these failure surfaces have generally developed along fault or fracture zones, or geologic contacts. Active rockslides were not observed during CTE's recent investigations; however, conditions for potential active rockfall/rocksliding are present at the site.

During CTE's investigation, a possible landslide type failure was observed at the site. Additional evaluation of the possible landslide hazard is provided in "Slope Stability Evaluation" attached as Appendix D which indicates this feature is a product of differential erosion and uncontrolled grading, and is not indicative of slope failure.

5.2.2 County of San Diego Rockfall Hazards

Rockfalls have occurred on natural slopes in the County of San Diego granitic terrain, likely due to destabilization by erosion or seismically induced ground shaking. Rockfalls in the San Diego area historically have been associated with steep, man-made excavations triggered by an event such as a storm or other circumstance that introduced water to a slope or caused erosion and undercutting of materials supporting a slope (SGC, 2002). Typically, rockfall events in "granitic" cut slopes in eastern County of San Diego are promoted by adverse rock-mass conditions where unstable rock blocks are dislodged from within or above graded cut slopes during heavy rainfall or seismic events (Hamelehle, 1991).

5.3 Evaluation of Rockfall Hazard

Investigations by RBF Consulting (2003) at the Welk Garden Villas site concluded that potential rockfall impacts are considered "less than significant." Furthermore, investigations by VME (1999, a,b,c) at adjacent sites did not conclude rockfall as a potential hazard.

Historical and recent aerial photographs of the site were reviewed for evidence of rockfalls. Photographs from 1953 (USDA, AXN-3m-164, -163), 1978 (210-22a-21), 1994, and 2003 were observed in 2003 at the USDA office in Escondido, California. Figure 2 is a 1994 aerial photograph showing site conditions. Site photographs of typical boulders at the site are presented in Appendix C. Evidence of unvegetated terrain indicative of recent rockfall, rockslides, or landslides were not observed in the reviewed aerial photographs. CTE has not been provided historic verbal recounts of rockfalls at the site.

5.4 Rockfall Characteristics

Natural rockfalls can be defined as events occurring on natural cliffs, not road or mine cuts, and occur without human intervention (Dussauge-Peisser, 2002). The word "rockfalls" is usually used to describe phenomena, from block fall of a few cubic yards (yd^3) up to 10,000 yd^3 events, and may include mobilization of individual boulders greater than one foot in maximum dimension. "Rockslides" often involve more than 100,000yd^3 and "rock avalanches" can reach several million cubic yards (Dussauge-Peisser, 2002).

Rockfalls may be initiated by climatic or biological event that causes a change in the forces acting on a rock. These events may include pore pressure increases due to rainfall infiltration, erosion of surrounding material during heavy rain storms, freeze-thaw processes in cold climates, chemical degradation or weathering of the rock, root growth or leverage by roots moving in high winds (Hoek, 2000). Additionally, seismically induced loads can initiate substantial wide scale rockfalls in hillside boulder terrain such as occurred in the San Bernardino Mountains and south adjacent Morongo Basin during the Landers and Big Bear earthquake events in 1992 and the 1999 Hector Mine earthquake that were mainly located in San Bernardino County.

5.5 Site Rockfall Hazard Evaluation

5.5.1 Rock-type

The site is underlain by Cretaceous "granitic" rocks of the southern California batholith. The semi-arid climate of County of San Diego generally results in chemical and mechanical reduction of granitic rock along joints and fractures as surface exposures are subjected to seasonal rains and temperature fluctuations throughout the year. This surface weathering condition often generates "grus and corestone" systems characterized as soil like granitic rock material adjacent to joint fractures with relatively unweathered hard boulders within the interior portions of the joint-bound rock block (Hamelehle, 1990).

"Granitic" rock at the site qualitatively ranged from weak to extremely strong. The degree of weathering within granitic rock masses is a controlling factor for rockfall potential in cut slopes (Hamelehle, 1991). Rock exposed along the east cut slope of Lot 1 and in pioneer road cuts of Lot 2 displayed varying degrees of weathering from loose soil like to very dense, impenetrable boulder masses. Rock at the lower potion of the Lot 2 slope was moderately to highly weathered. Test pit excavations in Lot 1 performed in January 2007 (see Appendix D) readily penetrated near surface soils but experienced increasing resistance to excavation with refusal at depths no greater than 10 feet. Boulder masses exposed at the ground surfaces were very dense and impenetrable by hand and backhoe means.

5.5.2 Slope Gradient, Boulder Shape, and Slope Surface

Slope ratio in the site area ranged from approximately 1:1 to 2:1 (horizontal: vertical). Topography on sloping areas of Lot 1 and Lot 2 varies from generally planar to hummocky due to pioneer road cuts. The slope surface is generally heavily vegetated with tall grass, brush and sparse trees, and is covered with residual soils or slopewash.

Boulders located in the project area have a subangular to subrounded shape. The east portion of the property above proposed retaining walls, and slopes above Welk Drive show boulders that may be susceptible of rolling down slope. Boulders that may affect the site by downslope displacement are shown on Figure 5.

5.5.3 Rock Outcrops

Rock outcrops are primarily exposed in pioneer road cuts in Lot 2. These outcrops are generally weathered "granitic" bedrock. Joint sets in theses outcrops were mapped and measured. The resulting joint patterns have produced irregular, blocky-shaped outcrops. Joint sets in the exposed bedrock outcrops generally consisted of planar to wavy, ¼ inch aperture, soil- to quartz-filled, spaced from one inch to 24 inches. Based on our observations, there may be a potential for a block to detach from these outcrops. However, due to the blocky nature of the rock it is unlikely that the block would be capable of rolling down slope and impacting the proposed improvements.

5.6 Rockfall Hazard Evaluation Methodology

A search was performed to assess possible quantitative methods for evaluating the potential for destabilization of individual boulders, which is considered to represent the site rockfall hazard. CTE discussed quantitative methods for evaluating individual boulder mobilization (rockfall) with Dr. Greg Stock, geologist evaluating rock slides in Yosemite National Park, and members of the Colorado Department of Transportation, developers of the Colorado Rockfall Simulation Program (CRISP). However, these sources indicated they were unaware of mathematical models to simulate destabilization of individual boulders such as to be evaluated at the Canyon Villas project. Consequently, rockfall hazards at the site were evaluated through qualitative assessment of boulders exposed at the ground surface of sloping portions of Lot 1 and Lot 2.

Qualitative methods to identify boulders potentially subject to destabilization (rockfall) were generally associated with boulder shape and estimated depth of embedment. Boulders with a vertical exposed height greater than upslope horizontal dimension and/or estimated to be embedded into soil less than one-third of their estimated maximum vertical dimension were considered to be potentially susceptible to destabilization. Minimum dimension for destabilization was approximately one foot in areas that were not covered with dense vegetation.

Based upon the qualitative parameters CTE located boulders and boulder groups for location survey by Hale Engineering. The latitude and longitude location of the located boulders considered susceptible to mobilization are shown on attached Figure 5, "Boulder Location Map." In addition to individual boulders, the map shows boulder groups where boulders spalled into individual masses and "boulder trains."

5.7 Rockfall Project Design Measures

Rockfall project design measures are recommended in the following text to reduce potential rockfall hazards at the Canyon Villas project. Consequently, from a geotechnical perspective, rockfall hazards should not preclude site development, provided the following recommended design features are implemented.

It is understood that access to upslope areas beyond the limit of grading is not available to mechanized equipment. Consequently, rockfall project design features to stabilize individual boulders and groups is considered to be by hand or aerial methods. Design measures as described below should be implemented prior to mass grading to minimize hazards associated with boulder destabilization effects on human health, property and the environment.

Selection of design features is based upon the following criteria:

- Hand or aerial placed methods to minimize site disturbance,
- Practicability of placement/implementation,
- Overall longevity,
- Resistance to erosion, and
- Minimal maintenance.

These project design measures include the following numbered elements:

1. Based upon a 15 degree from either side of fall line a boulder is not considered to impact the proposed development.
2. Boulder removal by equipment during grading of Lot 1.
3. Restraining cable(s) placed in drill holes to secure boulders in place.
4. Cofferdams at the toe of individual boulders to increase effective embedment.
5. Mechanical splitting by drill holes in combination with chemical expansion agents or "boulder buster" (shot gun shell size explosive charge and water hammer effects in a hole drilled into a boulder).
6. In place mechanical/pneumatic reduction and shaping of boulders to remain in place.
7. Pit excavation and embedment of rock particles.
8. A top of cut slope low (three feet or less) height debris fence consisting of steel rail/cable with post support to collect rock particles a foot or less in maximum dimension.

Following Table 5.7 shows recommended project design measures to stabilize boulders from mobilization as rockfall. The design features are numbered in accordance with the preceding list, and referenced boulders are located on the attached Figure 5.

TABLE 5.7

RECOMMENDED PROJECT DESIGN MEASURES PER BOULDER

Boulder	Notes	Project Design Measures (see numbered list on preceding page)
B-1	Single substantial* large boulder with adjacent spalled boulders	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape spalled boulders, construct cofferdam, embed particles as necessary.
B-2	Single substantial large boulder with a few local spalled boulders	3, 4, 5, 6, 7: restrain large boulder(s) in place, reduce and shape spalled boulders, construct cofferdam and embed particles as necessary.
B-3	Single substantial large boulder with a few local spalled boulders	1: does not project toward the development
B-4	Single substantial large boulder with a few local spalled boulders	1: does not project toward the development.
B-5	Single Boulder	2: within grading limits to be removed by equipment.
B-6	Vicinity of former reservoir; single boulder to include boulder approx. 100' south. Also, remnant reservoir debris.	4,5,6,7: reduce and shape particles, construct cofferdam, embed particles as necessary. Remove remnant reservoir debris (wood, metal etc.).
B-7	Single Boulder	2: within grading limits to be removed by equipment.
B-8	Single Boulder	2: within grading limits to be removed by equipment.
B-9	Single substantial large boulder with a few local spalled boulders	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary.
B-10	Single Boulder	2: within grading limits to be removed by equipment.
B-11	Single Boulder	2: within grading limits to be removed by equipment.
B-12	Single Boulder	2: within grading limits to be removed by equipment.
B-13	Single substantial boulder with numerous adjacent spalled boulders	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary.
B-14	Single Boulder	2: within grading limits to be removed by equipment
B-15	Boulder group	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary.
B-16	Boulder group	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape

		particles, construct cofferdam, embed particles as necessary.
B-17	Single substantial boulder with a few local spalled boulders	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary.
B-18	Boulder group	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary.
B-19	Boulder group	2: within grading limits to be removed by equipment.
B-20	Single Boulder	2: within grading limits to be removed by equipment.
B-21 (group)	Substantial boulders and adjacent spalled boulders	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary.
B-22 (group)	Boulder group	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary.
B-23	Substantial boulder group and adjacent spalled boulders; oak tree nearby	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary. Do not disturb oak tree.
B-24	Substantial boulder group and adjacent spalled boulders;	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary. Do no disturb oak tree.
B-25	Boulder group	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary.
B-26	Boulder group	3, 4, 5, 6,7: restrain boulder(s) in place, reduce and shape particles, construct cofferdam, embed particles as necessary.

*A boulder or boulder group was considered "substantial" by qualitative means to indicate an obvious physical feature possibly, though not always, greater than 10 feet in maximum dimension.

CTE recommends project design measures numbers 3, 4, 7 and 8 be constructed with at least as 50 year design life to include epoxy coated restraining cables, commercial grade concrete in cofferdam and embedment areas.

It is anticipated the construction area where project design measures are recommended for implementation is as shown on Figure 5, and should be delineated by temporary barricade fencing during implementation. The design features presented in Section 5.7 should be further evaluated by CTE during the project construction phase.

6.0 RIPPABILITY EVALUATION

6.1 Field Investigations

Seismic refraction surveys were performed at the northeast limits of the subject site. Two generally east-west traverses were performed near the northeast limits of the site along the area of the preliminarily proposed cut slopes and retaining walls. The seismic refraction surveys were performed to evaluate rippability of site materials based on the preliminarily proposed improvements. The approximate locations of the individual traverses (S-1 and S-2) are shown on Figure 4.

6.2 Evaluation of Site Rippability

The purpose the rippability evaluation was to evaluate the potential for encountering very dense or hard bedrock that would be unrippable by standard heavy-duty construction equipment. The following summarizes our findings and provides information on conditions that can be anticipated at the site.

The seismic refraction surveys or runs (S-1 and S-2) indicate that two distinct materials are present beneath the site. The table below shows the resulting shear wave velocities from the two runs performed.

Seismic Traverse No.	Approximate Velocity (ft/sec)	Approximate Minimum Depth Beneath Surface (ft)	Approximate Velocity (ft/sec)	Approximate Minimum Depth Beneath Surface (ft)	Comments
	Material 1 – Upper Material		Material 2 – Lower Material		
S-1	2,050	0 to 30	7,150	> 30	Unrippable At Depth
S-2	2,000	0 to 15	15,550	> 15	Unrippable At Depth

Appendix E contains information for approximate correlation between the shear wave velocity and rippability by standard heavy-duty earthwork equipment. Based on our review of the shear wave velocities of onsite materials, and our experience, we anticipate lower material observed at the site (i.e., materials below depths of 15 to 30 feet below grade, depending on location) will not be rippable by standard equipment. As such, if these materials are to be excavated during site earthworks, alternative removal techniques (i.e., rock-breaking equipment, blasting, chemical splitting, etc.) may be necessary. However, provided rock breaking and/or blasting is conducted in accordance with County of San Diego and/or other applicable ordinances, unrippable rock materials beneath the site would not adversely affect the proposed development.

Further rippability evaluation is provided by geophysical data for the slope stability evaluation (Appendix D). These data indicate irregular distribution of unrippable material with the approximate lower one half of the east proposed cut requiring very difficult excavation techniques.

Based on our review of the preliminary grading plans, we anticipate excavations required for the proposed cut slopes and retaining walls would require substantial removal of unrippable rock. Oversize rock would likely be generated by excavation in the hard rock area and special handling with disposal of oversize particles should be anticipated. However, it is our opinion that the unrippable rock material beneath the subject site would not preclude site development.

6.3 Additional Considerations

The findings of the slope stability evaluation (Appendix D) provides additional information for development consideration including oversize rock disposal and upslope reservoir system as discussed in the following.

Heavy ripping and rock splitting techniques will likely generate oversize irreducible particles. These materials may be crushed, used for ornamental slope or otherwise properly handled.

Remains of an upslope above ground reservoir system and piping are east of the proposed east most cut slope. The reservoir system remnants and piping should be removed as shown on Table 5.7, Boulder B-6 note to reduce potential uncontrolled water flow over proposed slope.

These additional issues do not preclude development as the site and are readily reduced by standard construction techniques.

7.0 CONCLUSIONS

CTE concludes that the proposed project can be developed from a geotechnical standpoint. Potential geologic hazards such as rockfall, liquefaction and seismicity are readily addressed by standard grading and construction project design measures. Additional subsurface investigation is recommended to evaluate site conditions and subgrade materials, and provide geotechnical engineering recommendations for project design and construction.

8.0 LIMITATIONS OF INVESTIGATION

The recommendations provided in this report are based on the anticipated construction, encountered subsurface conditions, and review of pertinent documents available to CTE. This report has been prepared according to current geotechnical engineering practice and standard of care exercised by reputable geotechnical consultants performing similar tasks in this area. No other warranty, expressed or implied, is made regarding the conclusions, recommendations and opinions expressed in this report. Variations may exist and conditions not observed or described in this report may be encountered during construction.

Our conclusions and recommendations are based on an analysis of the observed conditions. If conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if required, will be provided upon request. We appreciate this opportunity to be of service on this project. If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully submitted,
CONSTRUCTION TESTING & ENGINEERING, INC.

Gregory F. Rzonca, CEG #1191
Senior Engineering Geologist

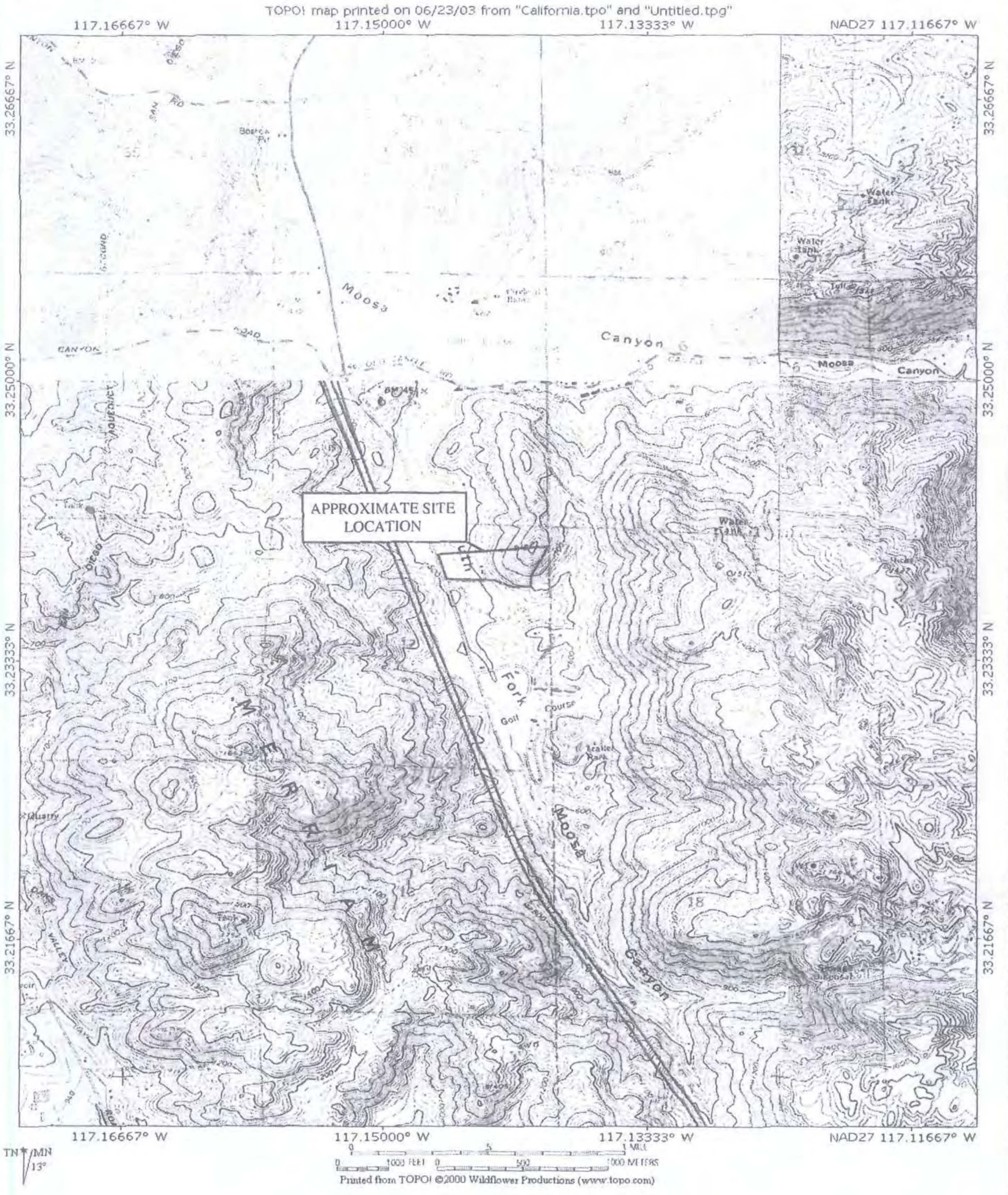
Dan T. Math, GE #2665
Principal Engineer

Distribution: (6)

GFR/DTM:nri

REGISTERED PROFESSIONAL GEOLOGIST
GREGORY F. RZONCA
No. 1191
CERTIFIED
ENGINEERING
GEOLOGIST
Exp. 8-31-09
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
DANIEL T. MATH
No. 2665
Exp. 12/31/10
GEOTECHNICAL
STATE OF CALIFORNIA



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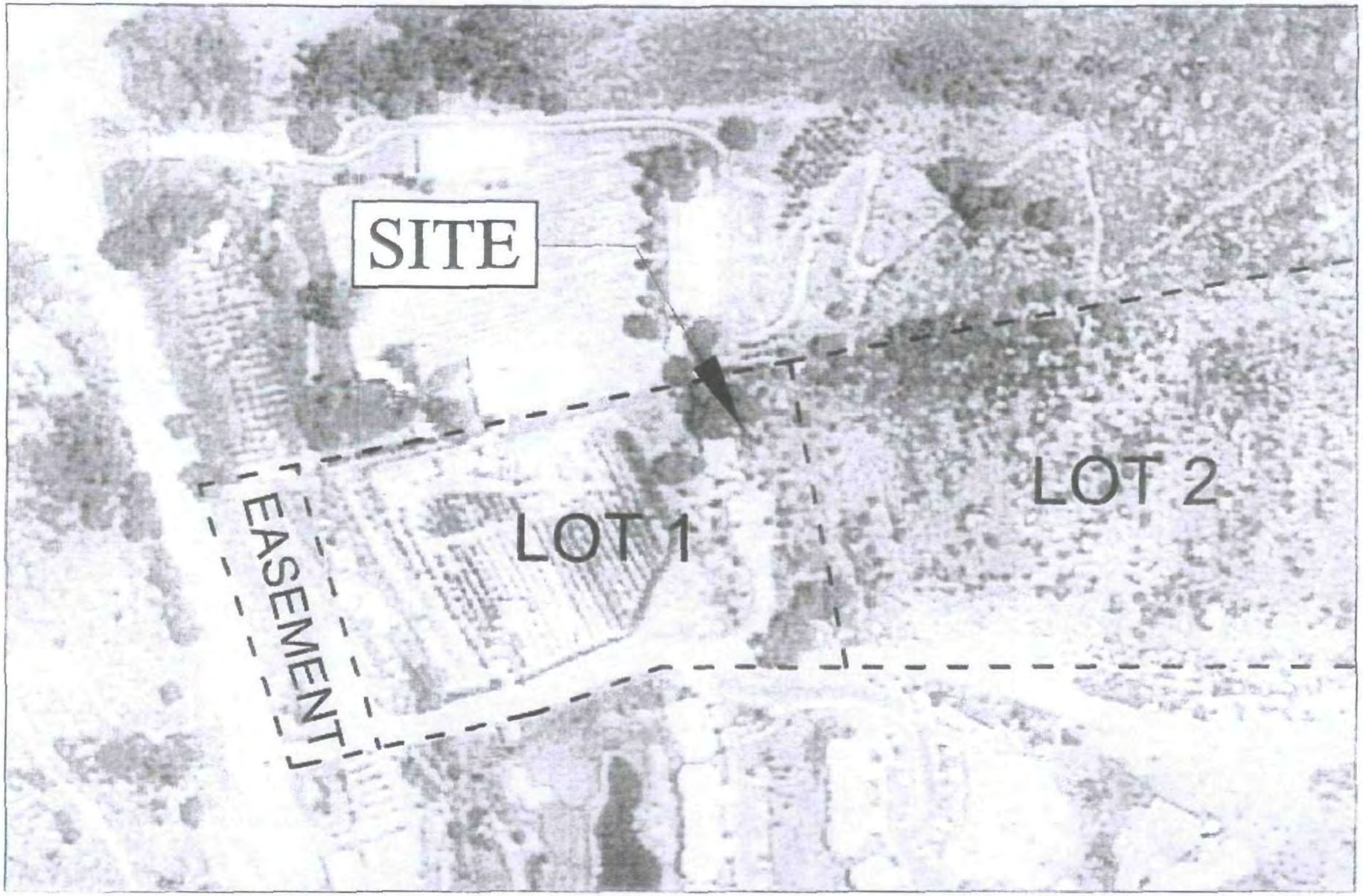
GEOTECHNICAL AND CONSTRUCTION ENGINEERING TESTING AND INSPECTION
2414 VINEYARD AVENUE, STE G ESCONDIDO CA. 92029 (760) 746-4955

SITE INDEX MAP
PROPOSED CANYON VILLAS
LAWRENCE WELK RESORT
ESCONDIDO, CALIFORNIA

CTE JOB NO: 10-6349	
SCALE: AS SHOWN	
DATE: 06/03	FIGURE: 1



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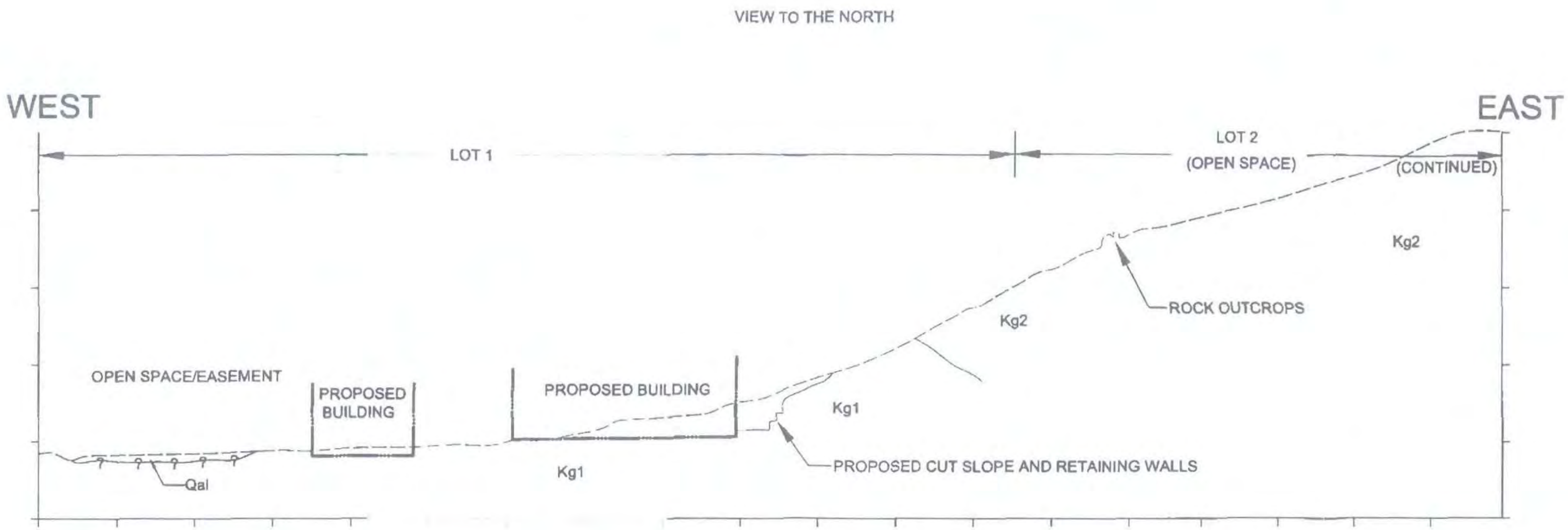
PLANNING - CIVIL ENGINEERING - LAND SURVEYING - GEOTECHNICAL
1441 MONTIEL ROAD, SUITE 115 ESCONDIDO CA. 92026, PH:(760) 746-4955

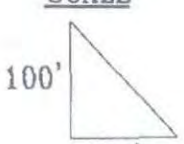
SITE AERIAL PHOTOGRAPH, 1994

PROPOSED CANYON VILLAS DEVELOPMENT
8860 WELK VIEW DRIVE
ESCONDIDO, CALIFORNIA

CTE JOB NO: 10-6305	
SCALE: 1"~180'	
DATE: 3/09	FIGURE: 2



SCALE



100'

80'

LEGEND

Qal	QUATERNARY ALLUVIUM DEPOSITS
Kg1	CRETACEOUS "GRANITIC" ROCK, MOSTLY BIOTITE TO HORNBLEND, ORANGE TO TAN, COARSE TO MEDIUM GRAINED, MASSIVE, INTENSELY TO MODERATELY WEATHERED, FRIABLE TO STRONG. (GRANODIORITE/UNDIFFERENTIATED)
Kg2	CRETACEOUS "GRANITIC" ROCK, MOSTLY BIOTITE GRANITE, GRAY TO WHITE, MEDIUM GRAINED, MASSIVE, MODERATELY WEATHERED, FORMS OUTCROPS AND BOULDERS. (SAN MARCOS GABBRO)

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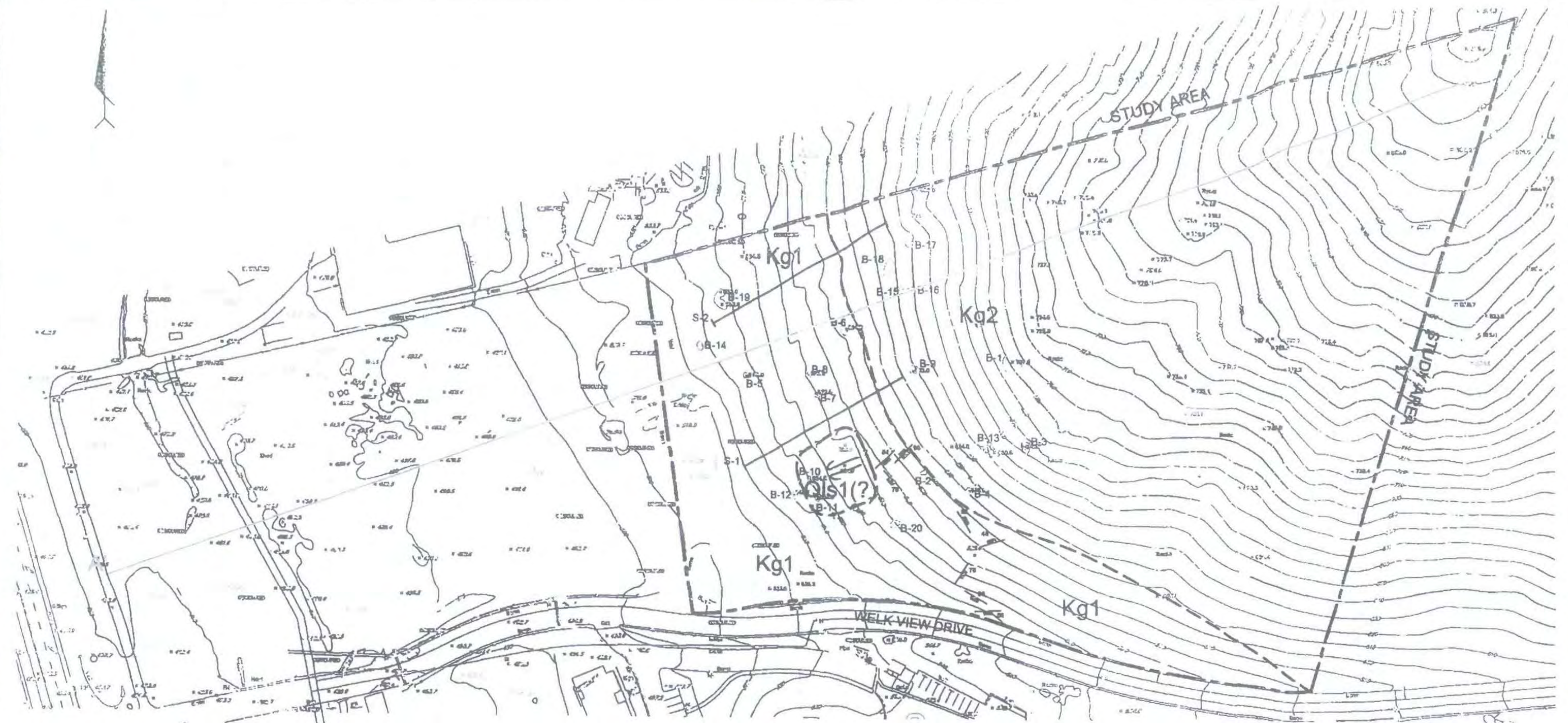
GEOLOGIC CROSS SECTIONS
PROPOSED CANYON VILLAS
LAWRENCE WELK RESORT
ESCONDIDO, CALIFORNIA

CTE JOB NO: 10-6349
SCALE: AS SHOWN
DATE: 3/09
FIGURE: 3



LEGEND

A ——— A' GEOLOGIC CROSS-SECTION

ROCKFALL HAZARD STUDY AREA

B-1 SURVEYED BOULDERS

Qls(?) LANDSLIDE DEPOSITS (QUESTIONABLE)

Kg1 CRETACEOUS "GRANITIC" ROCK
MOSTLY BIOTITE TO HORNBLENDE GRANITE, ORANGE TO TAN, COARSE TO MEDIUM GRAINED, MASSIVE, INTENSELY TO MODERATELY WEATHERED, FRIABLE TO STRONG.

Kg2 CRETACEOUS "GRANITIC" ROCK
MOSTLY BIOTITE GRANITE, GRAY TO WHITE, MEDIUM GRAINED, MASSIVE, MODERATELY STRONG TO VERY STRONG, MODERATELY WEATHERED TO SLIGHTLY WEATHERED, FORMS OUTCROPS AND BOULDERS.

68 STRIKE AND DIP OF JOINT

90 VERTICAL JOINT

INFERRED GEOLOGIC CONTACT

S-1 APPROXIMATE LOCATION OF SEISMIC REFRACTION SURVEY

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GEOTECHNICAL AND CONSTRUCTION ENGINEERING TESTING AND INSPECTION
2414 VINEYARD AVENUE, STE C ESCONDIDO CA 92029 (760) 746-4955

GEOLOGIC MAP
PROPOSED CANYON VILLAS
LAWRENCE WELK RESORT
ESCONDIDO, CALIFORNIA

CTE JOB NO:	10-6349G
SCALE:	1" = 120'
DATE: 08/03	FIGURE: 4

BOULDER LOCATIONS		
BOULDER NUMBER	LATITUDE	LONGITUDE
B-1	33°14'17.7341"	117°08'42.4282"
B-2	33°14'19.2373"	117°08'37.5635"
B-3	33°14'19.5329"	117°08'36.1569"
B-4	33°14'19.0178"	117°08'36.8959"
B-5	33°14'20.3477"	117°08'40.0118"
B-6	33°14'20.8166"	117°08'38.8203"
B-7	33°14'20.1581"	117°08'39.0416"
B-8	33°14'20.3752"	117°08'39.1407"
B-9	33°14'20.4206"	117°08'37.6977"
B-10	33°14'19.1432"	117°08'39.0989"
B-11	33°14'18.9234"	117°08'38.9902"
B-12	33°14'18.8757"	117°08'39.3365"
B-13	33°14'19.4813"	117°08'36.5821"
B-14	33°14'20.6784"	117°08'40.6655"
B-15	33°14'21.3448"	117°08'37.9348"
B-16	33°14'21.3539"	117°08'37.7479"
B-17	33°14'21.8739"	117°08'37.7661"
B-18	33°14'21.6152"	117°08'35.0836"
B-19	33°14'21.2359"	117°08'40.3857"
B-20	33°14'18.6209"	117°08'37.9238"
GROUP-21	33°14'19.5243"	117°08'37.1661"
GROUP-22	33°14'21.3099"	117°08'36.5671"
GROUP-23	33°14'22.0597"	117°08'35.7909"
GROUP-24	33°14'21.0894"	117°08'35.9246"
GROUP-25	33°14'21.1645"	117°08'36.4041"
GROUP-26	33°14'22.1184"	117°08'36.6104"

LEGEND

APPROXIMATE LOCATION OF PROPOSED TEMPORARY CONSTRUCTION TRAIL

APPROXIMATE LOCATION OF SHORT DEBRIS FENCE

CONSTRUCTION TESTING & ENGINEERING, INC.
PLANNING - CIVIL ENGINEERING - LAND SURVEYING - GEOTECHNICAL
124 EAST 30TH STREET, SUITES B AND C NATIONAL CITY CA 91950, PH:(619) 649-4000

BOULDER LOCATION AND PROJECT DESIGN FEATURE MAP

CANYON VILLAS AT THE CREEK
WELKS RESORT
COUNTY OF SAN DIEGO, CALIFORNIA

10-6349	
1" ~ 60'	
4/09	5

APPENDIX A

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REFERENCES CITED

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2. Dussauge-Peisser, Helmstetter, Grasso, Hantz, Desvarreux, Jeannin, and Giraud, 2002, "Probabilistic Approach to Rock Fall Hazard Assessment: Potential of Historical Data Analysis", Natural Hazards and Earth Systems Science, European Geophysical Society.

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14. Vinje & Middleton Engineering, Inc., 1999b, "Preliminary Geotechnical Investigation, Proposed Lawrence Welk Resort Redevelopment, Phase II of Villas on the Green, Lawrence Welk Drive, County of San Diego, California" [Consultant Report].

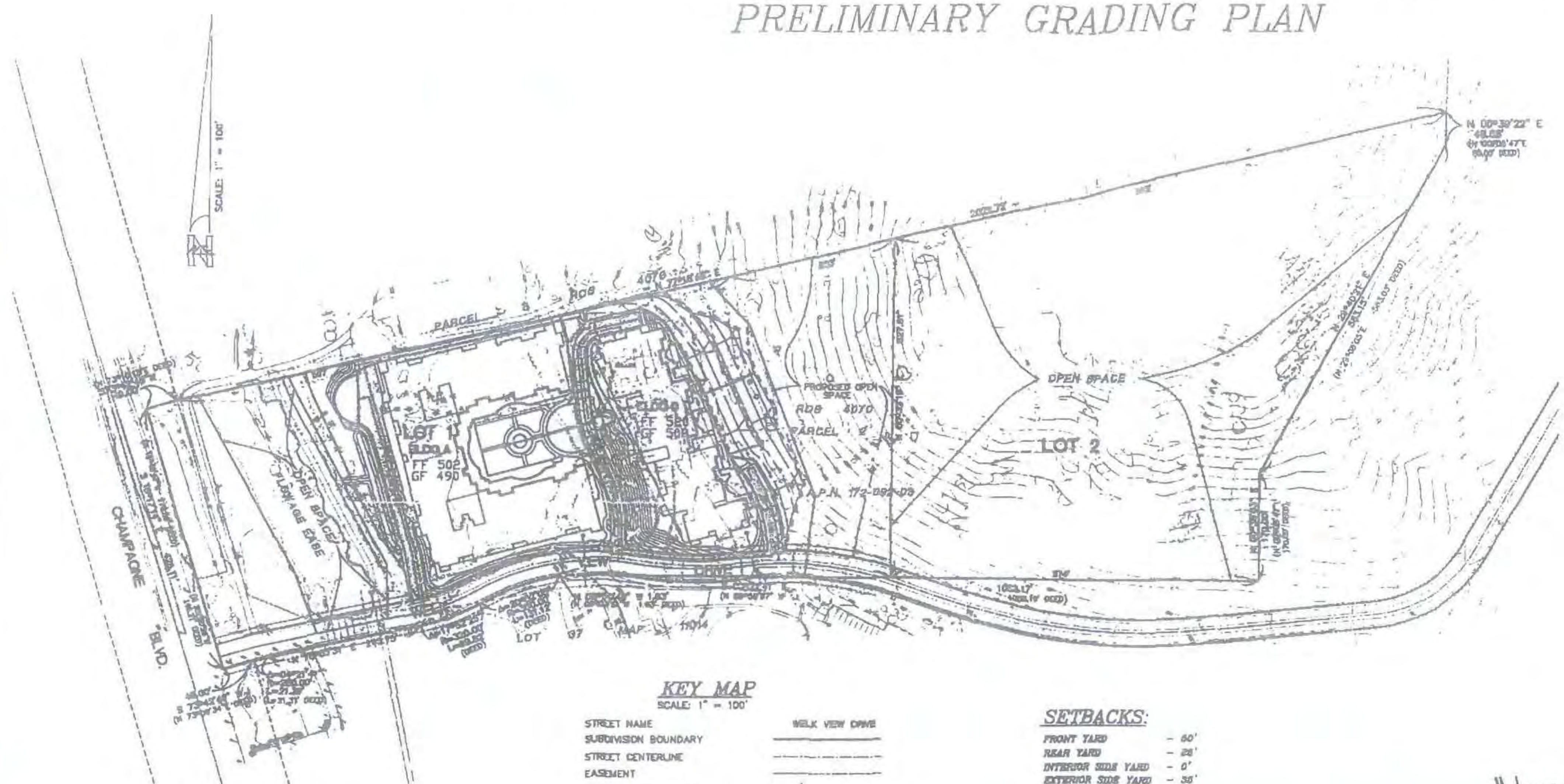
15. Vinje & Middleton Engineering, Inc., 1999c, "Preliminary Geotechnical Investigation, Proposed Lawrence Welk Resort Redevelopment, Phase III of Villas on the Green, Lawrence Welk Drive, County of San Diego, California" [Consultant Report].

APPENDIX B

PRELIMINARY GRADING PLAN

COUNTY OF SAN DIEGO TRACT NO. 5313 RPL 4

PRELIMINARY GRADING PLAN



LEGEND

- SUBDIVISION BOUNDARY
- STREET CENTERLINE
- EASEMENT
- PROPOSED OPEN SPACE
- LIMIT OF 100 YEAR FLOOD PLAIN
- LIMIT OF 100 YEAR FLOOD WAY
- PROPOSED BUILDING
- PROPOSED BELOW GRADE PARKING STRUCTURE
- PROPOSED STORM DRAIN
- PROPOSED CLEAN OUT
- PROPOSED CURB INLET
- PROPOSED HEADWALL
- EXISTING WATER MAIN
- EXISTING SEWER MAIN
- PROPOSED WATER MAIN
- PROPOSED FIRE HYDRANT
- PROPOSED SEWER MANHOLE
- PROPOSED SEWER MAIN
- PROPOSED CURB AND GUTTER
- PROPOSED BROW DITCH
- DIRECTION OF DRAINAGE
- PROPOSED CONTOUR
- EXISTING CONTOUR
- PROPOSED SLOPE (MAX CUT:1.5:1) (MAX FILL: 2:1)
- PROPOSED RETAINING WALL
- PROPOSED P.C.C. PAVING
- PROPOSED A.C. PAVING

GENERAL NOTES

1. ALL GRADING WILL BE TO COUNTY SPECIFICATIONS. THE GRADING SHOWN IS TENTATIVE AND MAY BE MODIFIED DURING FINAL MAP PREPARATION.
2. ALL FILL SLOPES ARE 2:1 OR AS APPROVED BY SOILS ENGINEER AFTER FIELD INVESTIGATION.
3. ALL CUT SLOPES ARE 1.5:1 OR AS APPROVED BY SOILS ENGINEER AFTER FIELD INVESTIGATION.
4. ALL STREETS ARE PRIVATE.
5. THE PAD GRADING CONSTRAINTS ARE AS FOLLOWS:

MAX. CUT SLOPE HEIGHT :	37' MAX
MAX. FILL SLOPE HEIGHT :	11' MAX
EXCAVATION:	48,300 C.Y.±
FILL:	13,000 C.Y.±
EXPORT:	35,300 C.Y.±
MAX WALL HEIGHT:	15'±

EARTHWORK QUANTITIES INCLUDE ROADWAY EXCAVATION/EMBANKMENT

KEY MAP

SCALE: 1" = 100'

STREET NAME	WELK VIEW DRIVE
SUBDIVISION BOUNDARY	
STREET CENTERLINE	
EASEMENT	
EXISTING OPEN SPACE	
PROPOSED LOT LINE	
LOT NUMBERS	LOT 1

SETBACKS:

FRONT YARD	- 50'
REAR YARD	- 25'
INTERIOR SIDE YARD	- 0'
EXTERIOR SIDE YARD	- 35'

ACREAGE/LOT:

A.	GROSS ACREAGE	20.69 ACRES
B.	NET ACREAGE	19.36 ACRES
C.	TOTAL NUMBER OF LOTS	2

WELK RESORT GROUP
100 E. SAN MARCOS BLVD. STE. 100
SAN MARCOS, CA. 92069
PHONE (760) 481-7777

JON FREDRICKS DATE

CIVIL ENGINEER

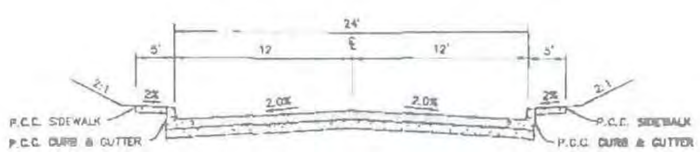
HALE ENGINEERING
7910 CONVOY COURT
SAN DIEGO, CA 92111
(858) 715-1420

MARK L. HENNING DATE
R.C.E. 58007

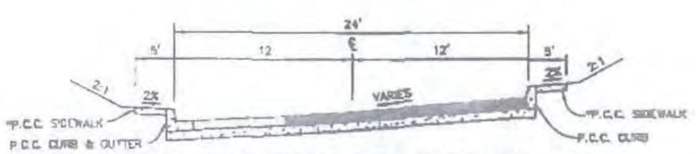
EARTHWORK QUANTITIES:

53,600 (EXCAVATION) 10,900 (FILL) 42,600 EXPORT

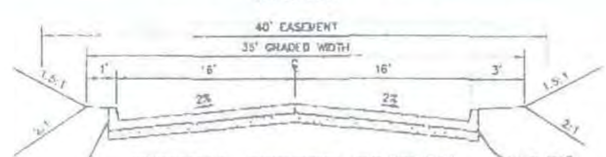
100 0 100 200 300
SCALE 1" = 100'



TYPICAL PRIVATE DRIVEWAY SECTION
PRIVATE DRIVEWAY 'A'
NOT TO SCALE



TYPICAL PRIVATE DRIVEWAY SECTION
PRIVATE DRIVEWAY 'B'
AND EMERGENCY ACCESS 'A'
NOT TO SCALE



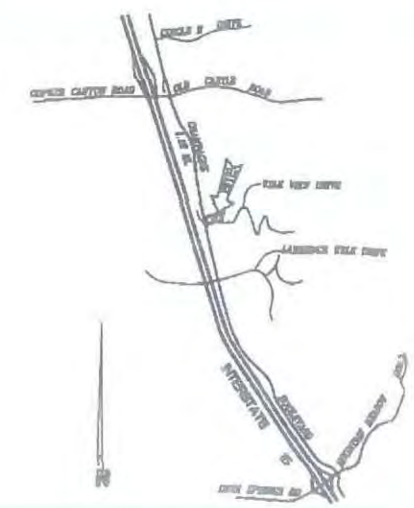
TYPICAL STREET SECTION
WELK VIEW DRIVE (EXIST. PVT. ROAD)
NOT TO SCALE

NOTES:
THIS PLAN IS PROVIDED TO ALLOW FOR FULL AND ADEQUATE DISCRETIONARY REVIEW OF A PROPOSED DEVELOPMENT PROJECT. THE PROPERTY OWNER ACKNOWLEDGES THAT ACCEPTANCE OR APPROVAL OF THIS PLAN DOES NOT CONSTITUTE AN APPROVAL TO PERFORM ANY GRADING SHOWN HEREON, AND AGREES TO OBTAIN A VALID GRADING PERMIT BEFORE COMMENCING SUCH ACTIVITY.

POST-CONSTRUCTION/STRUCTURAL BEST MANAGEMENT PRACTICES (BMPs) SHOWN ON THIS PLAN CONSIST OF THE FOLLOWING:

- CONCRETE BROW DITCHES AT TOPS OF CUT SLOPES
- BERMS AT TOPS OF FILL SLOPES
- FILTERED STORM DRAIN INLETS SERVING PRIVATE DRIVEWAYS

LOCATIONS AND SIZES OF EXISTING UTILITIES SHOWN HEREON HAVE BEEN APPROXIMATED USING DATA FROM IMPROVEMENT PLANS AND TOPOGRAPHIC SOURCES AND ARE INTENDED FOR PRELIMINARY DESIGN USE ONLY. ACTUAL SITE CONDITIONS MAY DIFFER.



VICINITY MAP
NOT TO SCALE

LEGAL DESCRIPTION

PORTION OF PARCEL 1 OF DEED TO TELEVIEW PRODUCTIONS, INC. A CALIFORNIA CORPORATION RECORDED JULY 28, 1988 AS FILE NO. 88-330140 OF OFFICAL RECORDS OF THE COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, TOGETHER WITH PORTION OF LOT 37 OF COUNTY OF SAN DIEGO TRACT NO. 4417, ACCORDING TO MAP NO. 11014, IN THE COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, RECORDED AUGUST 9, 1984 AS FILE NO. 84-304887 OF OFFICAL RECORDS OF SAN DIEGO COUNTY.

ASSESSOR'S PARCEL NUMBERS

A.P.N. 172-092-03 & -11, 185-363-09 & -20
TAX RATE AREA - 94106

SOURCE OF TOPOGRAPHY:

AERIAL SURVEY PROVIDED BY:
SAN-LO AERIAL SURVEYS
4575 VIEWRIDGE AVE.
SAN DIEGO, CA. 92123-1637
(858) 565-1084
FLOWN: 9-26-02

BENCHMARK:

"CROW-2" BRASS DISK SET IN 2 1/4" IRON PIPE SET BY CALIFORNIA DIVISION OF HIGHWAYS APPROXIMATELY 1/4 MI. N.E.'LY OF INTERSECTION OF CHAMPAGNE BLVD. & LAWRENCE WELK DR.

PREPARED BY:
HALE ENGINEERING
CIVIL ENGINEERING SURVEYING LAND PLANNING
7910 CONVOY COURT
SAN DIEGO, CA 92111
(858) 715-1420 (858) 715-1424 FAX

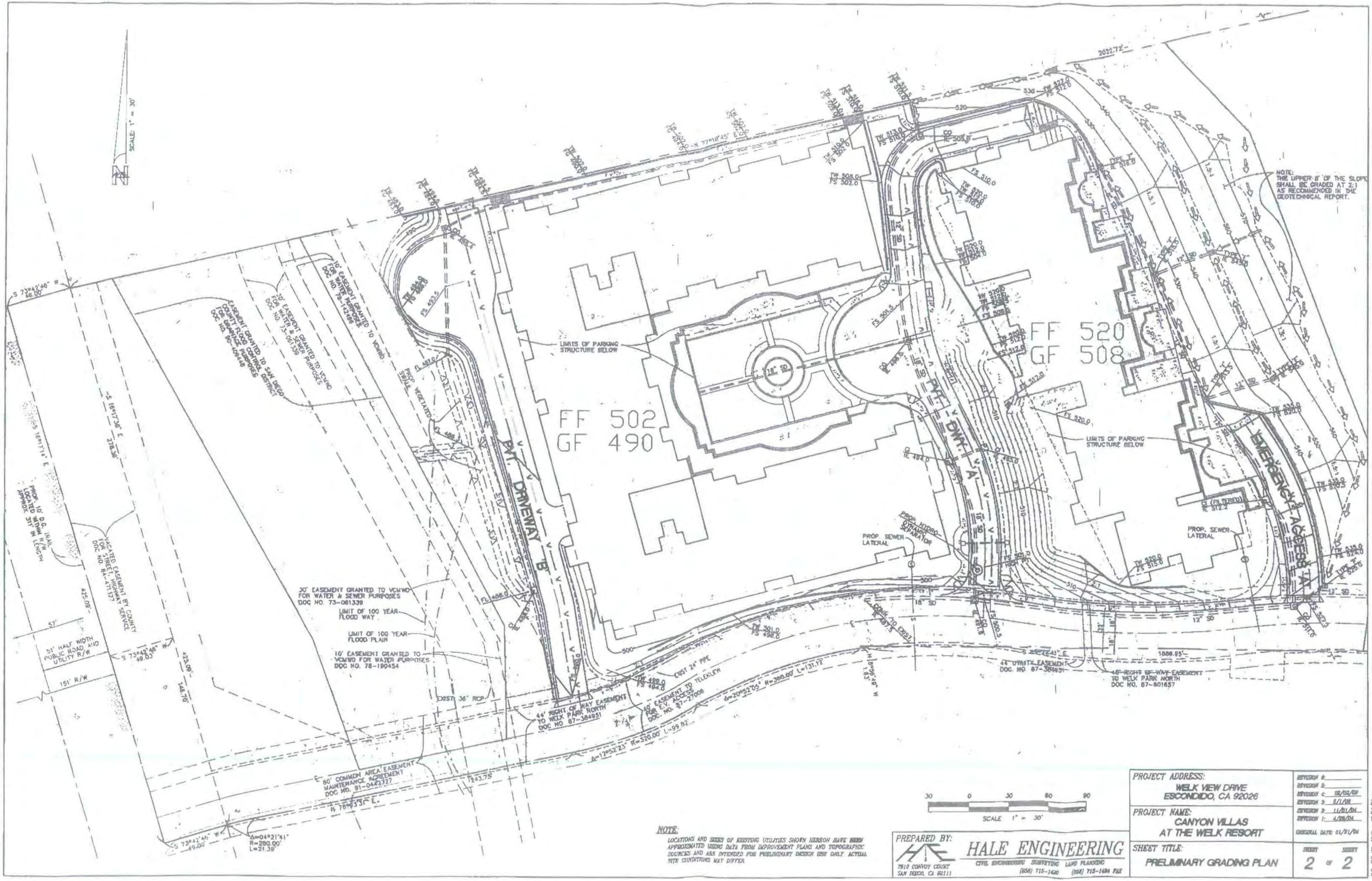
PROJECT ADDRESS:
WELK VIEW DRIVE
ESCONDIDO, CA 92026

PROJECT NAME:
CANYON VILLAS
AT THE WELK RESORT

SHEET TITLE:
PRELIMINARY GRADING PLAN

REVISION
REVISION 5:
REVISION 4: 08/22/05
REVISION 3: 5/1/05
REVISION 2: 11/01/04
REVISION 1: 4/20/04
ORIGINAL DATE: 01/21/04

SHEET 1 OF SHEET 2


FF 502
GF 490
FF 520
GF 508
PVT. DRIVEWAY "B"
PVT. DWY. "A"
EMERGENCY ACCESS "A"
LIMITS OF PARKING STRUCTURE BELOW
LIMITS OF PARKING STRUCTURE BELOW
NOTE: THE UPPER 8' OF THE SLOPE SHALL BE GRADED AT 2:1 AS RECOMMENDED IN THE GEOTECHNICAL REPORT.
PROP. SEWER LATERAL
PROP. SEWER LATERAL
30' EASEMENT GRANTED TO VCMWD FOR WATER & SEWER PURPOSES DOC NO. 73-081339
LIMIT OF 100 YEAR FLOOD WAY
LIMIT OF 100 YEAR FLOOD PLAIN
10' EASEMENT GRANTED TO VCMWD FOR WATER PURPOSES DOC NO. 78-190454
EXIST. 36" RCP
44' RIGHT OF WAY EASEMENT TO WELK PARK NORTH DOC NO 87-384951
40' EASEMENT TO TELEKLEW FOR E.V. ACCESS DOC. NO. 87-27008
44' UTILITY EASEMENT DOC. NO. 87-384951
48' RIGHT OF WAY EASEMENT TO WELK PARK NORTH DOC NO. 87-801657
80' COMMON AREA EASEMENT MAINTENANCE AGREEMENT DOC NO. 91-0442327
51' HALF WIDTH PUBLIC ROAD AND UTILITY R/W
151' R/W
SCALE 1" = 30'
NOTE:
LOCATIONS AND SIZES OF EXISTING UTILITIES SHOWN HEREON HAVE BEEN APPROXIMATED USING DATA FROM IMPROVEMENT PLANS AND TOPOGRAPHIC SOURCES AND ARE INTENDED FOR PRELIMINARY DESIGN USE ONLY. ACTUAL SITE CONDITIONS MAY DIFFER.
PREPARED BY:
HALE ENGINEERING
CIVIL ENGINEERING SURVEYING LAND PLANNING
7910 CONVOY COURT SAN DIEGO, CA 92111
(858) 715-1420 (858) 715-1484 FAX
PROJECT ADDRESS:
WELK VIEW DRIVE ESCONDIDO, CA 92026
PROJECT NAME:
CANYON VILLAS AT THE WELK RESORT
SHEET TITLE:
PRELIMINARY GRADING PLAN
REVISION 4: 02/02/05
REVISION 3: 8/1/05
REVISION 2: 11/01/04
REVISION 1: 4/28/04
ORIGINAL DATE: 01/21/04
SHEET 2 OF SHEET 2

APPENDIX C

SITE PHOTOGRAPHS

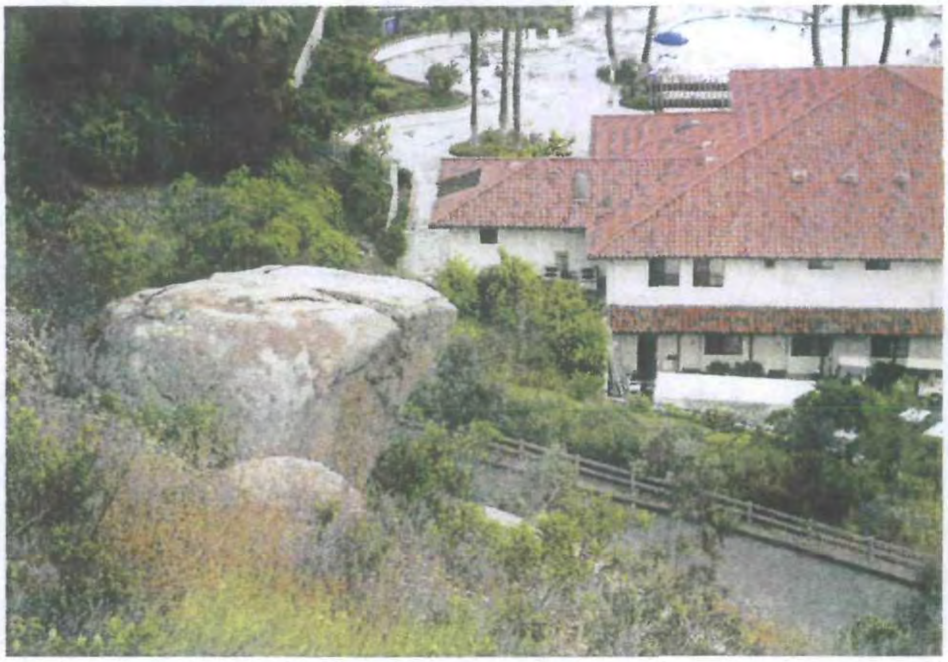


Photo #1: Typical boulder shape above Welk Drive area.

Photo #2: Typical boulder shape above proposed Canyon Villas site.

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GEOTECHNICAL AND CONSTRUCTION ENGINEERING TESTING AND INSPECTION
2414 VINEYARD AVENUE, STE G ESCONDIDO CA. 92029 (760) 746-4955

APPENDIX C
PROPOSED CANYON VILLAS
LAWRENCE WELK RESORT
ESCONDIDO, CALIFORNIA

CTE JOB NO: 10-6349	
SCALE: NO SCALE	
DATE: 6/03	PAGE: 1

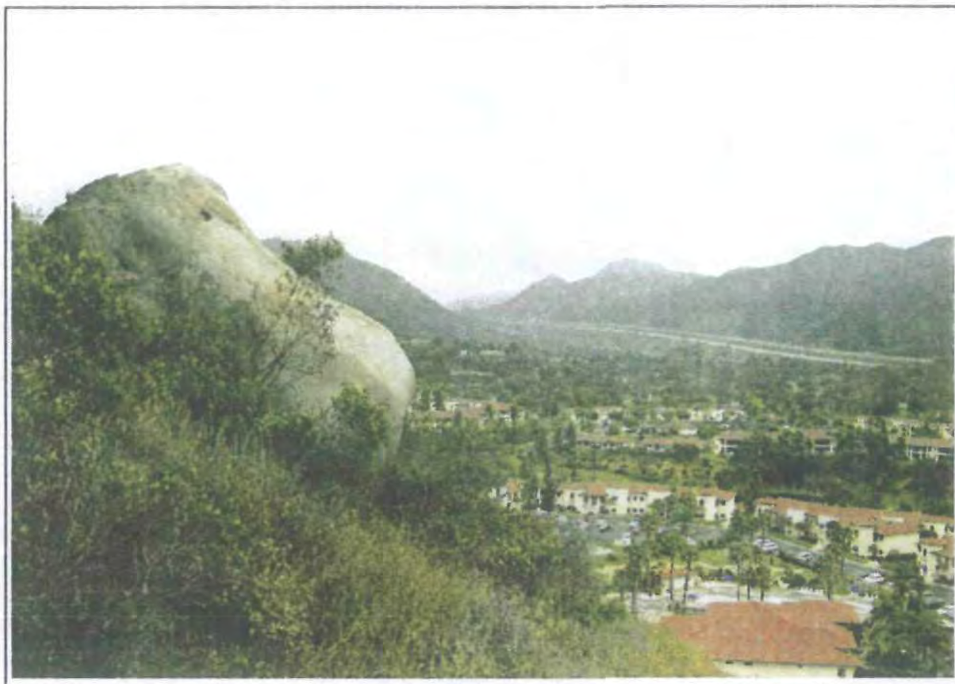


Photo #3: Typical boulder shape above proposed Canyon Villas site. Existing Villas on the Green development is in the background.

Photo #4: Fractured boulder LOT 5. Survey stake is approximately three feet long.

Photo #5: Slope above proposed Canyon Villa site.

Photo #6: Typical boulders shapes above proposed Canyon Villas site, Lot 5 area.

CONSTRUCTION TESTING & ENGINEERING, INC.
GEOTECHNICAL AND CONSTRUCTION ENGINEERING TESTING AND INSPECTION
2414 VINEYARD AVENUE, STE G ESCONDIDO CA. 92029 (760) 746-4955

APPENDIX C
PROPOSED CANYON VILLAS
LAWRENCE WELK RESORT
ESCONDIDO, CALIFORNIA

CTE JOB NO: 10-6349	
SCALE: NO SCALE	
DATE: 6/03	PAGE: 3

APPENDIX D

SLOPE STABILITY EVALUATION

CONSTRUCTION TESTING & ENGINEERING, INC.

SAN DIEGO, CA 1441 Montiel Rd Suite 115 Escondido, CA 92026 (760) 746-4955 (760) 746 9806 FAX
SAN DIEGO, CA 124 East 30th St. Suites B and C National City, CA 91950 (619) 649 4000 (619) 649 4039 FAX
RIVERSIDE, CA 14538 Meridian Pkwy Suite A Riverside, CA 92518 (951) 571-4081 (951) 571-4180 FAX
VENTURA, CA 1645 Pacific Ave Suite 107 Oxnard, CA 93033 (805) 486-6475 (805) 486-9016 FAX
TRACY, CA 242 W. Larch Rd Suite F Tracy, CA 95304 (209) 839-2890 (209) 839-2895 FAX
SACRAMENTO, CA 3628 Madison Ave Suite 22 N. Highlands, CA 95660 (916) 331-6030 (916) 331-6037 FAX
N PALM SPRINGS, CA 19020 Indian Ave Suite 2-K N. Palm Springs, CA 92258 (760) 329-4577 (760) 328-4896 FAX
MERCED, CA 3000 Beachwood Dr Merced, CA 95348 (209) 386-9933 (209) 386-9939 FAX

October 15, 2007

CTE Job No. 10-6349G

Welk Resort Center
Attn: Jeffrey Edwards
100 East San Marcos Blvd. Suite 100
San Marcos, CA 92069
Telephone: 760.481.7771

Facsimile: 760.481.7770

Subject: Slope Stability Evaluation
Welk Resort Canyon Villas
TM 5313; R03-004; S02-029; ER 79-08-099A
County of San Diego, California

References: At End of Document

Mr. Edwards:

Construction Testing and Engineering, Inc. (CTE) is pleased to provide this slope stability evaluation in response to a request by the County of San Diego. This document follows your authorization of the CTE proposal entitled *Proposal for Additional Slope Stability Evaluation*, CTE Pr. No.: G-1462A, dated February 27, 2007. The purpose of this document is to evaluate stability of the west facing cut slope on the east margin of the site proposed. The proposed cut is planned at a 1.5:1 (horizontal to vertical) surface ratio and extending to a height of 50 feet with a 15 feet high wall at the bottom of the south one-third of the slope.

The scope of our addendum investigation and evaluation includes the following:

- Review of the CTE documents entitled *Evaluation of Potential Rockfall Hazards* and *Geotechnical Feasibility Study*, dated July 9, 2003 and August 12, 2003, respectively.
- Review the *Preliminary Grading Plan*, revision 4 dated 8/17/07, scale 1"=30', and prepared by Hale Engineering.

- Review of pertinent readily available information as presented in Appendix 1 of this document.
- Additional reconnaissance level field mapping of the area on foot.
- Placing three seismic refraction and a high resolution Sting geophysical transects on the subject slope and suspect landslide area. The seismic work was performed by Southwest Geophysics, Inc. who are specialists in performing geophysical surveys.
- Placing four backhoe test pits in selected areas for the purposes of: ground truth verification of the geophysical transects; expose soil and bedrock for descriptions; and, soil sample collection for laboratory testing.
- Laboratory testing of collected samples to evaluate maximum dry density, optimum moisture content, and shear strength.
- Preparation of an engineering geologic cross section to allow quantitative slope stability analyses.
- Performing slope stability analyses utilizing the slope stability program GeoStudio 2004, Slope W, by Geo-Slope International, which for the purpose of this response, iteratively considered multiple hypothetical slip surfaces and failure modes in order to calculate the slope stability factors-of-safety.
- Preparation of this written response to comments letter.

Following is a presentation of the Addendum Field Investigation, Laboratory Testing, Geotechnical Analyses, Conclusions and Recommendations, and Limitations.

1.0 ADDENDUM FIELD INVESTIGATION

The addendum field investigation consisted of initial level geologic reconnaissance mapping to assess current site conditions. The reconnaissance mapping was followed by geophysical work that was performed on September 12 and 13, 2007. Initial results of the geophysical work were evaluated and four backhoe test pits placed on September 20, 2007 to allow ground truth verification of the geophysical work. Two of the four backhoe explorations were placed in the area of an suspected landslide identified by our August 12, 2003 report.

The test pit logs and Southwest Geophysics, Inc. (Southwest) geophysical survey report are attached as Appendix 2 and Appendix 3, respectively. The geophysical survey included three seismic refraction lines and one Sting line. Information regarding methodology and procedures utilized in the geophysical survey are provided in the attached Southwest report.

2.0 LABORATORY TESTING

Bulk samples of typical granodiorite bedrock were collected from Test Pit TP-2 at a depth of two to four feet below the existing surface. The samples were tested in the CTE geotechnical laboratory to ascertain strength parameters for use in slope stability calculations/evaluations.

The maximum dry density and optimum moisture content (resulting from ASTM D 1557 test procedure Method A) were utilized to remold the collected bulk sample to 90 percent of the maximum dry density at a moisture content slightly above optimum. The remolded sample was submitted to a direct shear test by ASTM D 3080-04 test procedure. The laboratory test results are shown on Appendix 4.

The resulting direct shear values of phi = 34.0 degrees with 275 pounds per square foot (psf) of apparent cohesion were obtained via the laboratory testing of the remolded sample. However, the following more conservative values were utilized in the slope stability calculations:

- Kgu (Weathered): Phi = 34 degrees, Apparent Cohesion, C = 250 psf
- *Kgu (Unweathered): Phi = 37 degrees, Apparent Cohesion, C = 350 psf

*Intact unweathered material strengths have been conservatively estimated/assumed to be equal to weathered strength for phi and C, and were increased by approximately 10% and 40%, respectively, due to their very dense nature as indicated by geophysical data. Additionally, based on geophysical survey information, significantly higher material strengths appear available, but were conservatively not utilized.

3.0 GEOTECHNICAL ANALYSES

These analyses consider gross natural slope stability and stability of the planned approximately 50 feet high 1.5:1 (horizontal to vertical) west facing cut slope on the east margin of the site. Based upon the scope of this slope stability evaluation, the natural slope is grossly stable against a deep-seated failure, and the proposed cut slope is calculated to have an adequate factor-of-safety for gross stability in excess of 1.5. The results of our additional work indicate at least the bottom approximate one-half of the subject cut will be very difficult to excavate. The analyses are presented as follows.

Gross Natural Slope Stability: Gross stability of the slope in its existing natural configuration was evaluated by geophysical and test pit exploration methods. The explorations were placed to consider a possible landslide, and evaluate the deep existing stability of the remaining hillside. Based upon field and laboratory results conducted for this slope stability evaluation the subject slope is considered grossly stable in its present and proposed conditions.

A possible landslide was postulated due to hummocky topography and a free face exposure of bedrock. The possible landslide feature was considered as uncertain and to be evaluated during grading. However, additional work performed for this slope stability evaluation indicates the suspected landslide feature is actually the result of a contact zone between bedrock formation units in combination with previous undocumented and uncontrolled grading to produce cuts and fills. Test Pits TP-1 and TP-4, located in the suspected landslide area, exposed a contact zone between Undifferentiated Granodiorite and the San Marcos Gabbro which developed local hard boulder outcrop zones and subdued surface expression of softer matrix material. Weathering of the combined harder and softer zones resulted in irregular topography, recognized as "hummocky," a possible indication of landsliding. Additionally, previous uncontrolled grading to produce "pioneer" roads, possibly to a water reservoir and associated piping upslope of the planned cut, generated free face exposures of bedrock, and fill soil mounds and berms. The free face exposure was considered as a possible landslide scarp, but as this report indicates, is actually the product of uncontrolled grading. Additionally, interpretation of the seismic refraction SI-1 (see Appendix 3 for geophysical report) depicts approximately three to four feet of low velocity soil (interpreted to be slopewash) over relatively uniform hard bedrock in the area of the suspected landslide. It is expected that a chaotic landslide mixture of bedrock would produce a deep geometrically defined low velocity geophysical signature comparative to results gathered for this slope stability evaluation.

Stability of natural slopes was evaluated by test pit exposures, and seismic refraction and Sting geophysical techniques. The results of the test pit exposures indicate that the site granitic bedrock becomes less weathered and increasingly dense with the depth explored (approximately eight feet). These results are supported by the geophysical work, which indicates a progressively increasing velocity (harder rock) to the maximum depth evaluated of approximately 50 to 60 feet below the ground surface. Only seismic refraction line SL-1 indicated a relatively uniform, albeit high velocity, density bedrock with depth, and may be the result of the line being underlain by San Marcos Gabbro, which tends to weather more uniformly with depth comparative to the Undifferentiated Granodiorite. Geophysical Sting technology utilizes closely spaced sensors to assess potential moisture anomalies that could be the result of wet clays or water bearing zones which at this site would be associated with geometrically defined geologic asperities such as landslides, faults or significant joint systems. The Sting line STL-1 results indicate non-geometric conditions, possibly showing near surface local hard rock masses in a bedrock matrix. However, a linear anomaly (shown by the Sting transet at about station 200 near the surface contact of Undifferentiated Granodiorite and San Marcos Gabbro) is interpreted in Cross Section A-A' to represent the subsurface contact of the two formational units. The Sting results indicate a general increase in uniformity with depth, suggesting decreased weathering in deeper bedrock areas. The results of our work indicate that the natural slopes are grossly stable.

Cut Slope Stability:
Gross stability of the proposed approximately 50-foot high 1.5:1 ratio west facing cut slope ascending from the east margin of the site was calculated by use of the commercially available stability program GeoStudio 2004, Slope W, by Geo-Slope International. The calculations/results/output are provided in Appendix 5. The calculations indicate the slope is grossly stable in the proposed configuration.

The slope stability calculations utilized an iterative combination of trial arcs to develop the most critical hypothetical failure surface, which yielded a minimum safety factor of 1.54 for static conditions and 1.13 for pseudo static loads (using a simple seismic horizontal coefficient of 0.15). The strength values utilized were from a remolded bulk sample of typical granitic bedrock. The use of remolded samples to approximate bedrock strength is very conservative as interlocked high strength crystalline fabric of in situ bedrock is disintegrated in order to remold the specimen. The remolded shear strength is considered representative of seismic velocities on the order of 4,000 feet and fewer feet per second (fps) which is the velocity at which the sample was collected. Consequently, deeper stability calculations which yielded seismic refraction velocities greater than 4,000 feet per second (fps), indicating increased density and strength, utilized appropriately higher, yet still conservative, strength parameters.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Work performed for this response to comments indicates the subject cut slope can be developed as planned, provided the recommendations of this response and pertinent CTE reports are followed. Following are conclusions and recommendations for the subject slope.

The natural slope is considered to be grossly stable and geotechnical engineering calculations indicate an adequate safety factor for deep stability of the proposed cut. The cut can be constructed as planned, provided the upper eight to ten feet of the cut is graded to a maximum 2:1 surface ratio in order to layback the upper weathered or slopewash materials.

The possible presence of a landslide in the area of the proposed subject cut was suggested based upon irregular topography. However, work performed and summarized herein indicates differential weathering of dissimilar rocks in combination with cut and fill of previous uncontrolled grading produced features suggesting a possible landslide. Consequently, this feature is not considered to be present, and does not provide a geotechnical issue to the planned cut slope.

Review of geophysical data conducted for this slope stability evaluation indicates that very difficult excavation will be encountered in at least the bottom one-half of the proposed cut. Blasting, rock splitting, heavy excavation will likely be necessary to accomplish the proposed subject cut. Special handling of over size rock resulting from excavation to produce desired grades will also likely be necessary.

The remains of an apparently above ground, water reservoir system were observed on portions of the subject cut area. Piping possibly associated with the former reservoir system should be removed to minimize the affects of uncontrolled water flow and discharge on the slope.

We appreciate this opportunity to be of service on this project. If you have any questions regarding this report, please do not hesitate to contact the undersigned.

Respectfully Submitted,

CONSTRUCTION TESTING & ENGINEERING, INC.

Dan T. Math, GE# 2665
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
DANIEL T. MATH
No. 2665
Exp. 12/31/10
GEOTECHNICAL
STATE OF CALIFORNIA

Gregory F. Rzonca, CEG# 1191
Senior Engineering Geologist

REGISTERED PROFESSIONAL GEOLOGIST
GREGORY F. RZONCA
No. 1191
CERTIFIED ENGINEERING GEOLOGIST
Exp. 8-31-09
STATE OF CALIFORNIA

GFR/DTM:nri
Dist: 6 Addressee

Attachments:

Figure A	Exploration Location and Geologic Map
Figure B	Cross Section A-A'
Appendix 1	Cited References
Appendix 2	Exploration Logs
Appendix 3	Geophysical Report
Appendix 4	Laboratory Test Results
Appendix 5	Slope Stability Analyses
Appendix 6	Glossary of Terms

LEGEND

TP-1 APPROXIMATE TEST PIT LOCATION

Qudf QUATERNARY UNDOCUMENTED FILL

Kgu GRANODIORITE (UNDIFFERENTIATED)

Ksm SAN MARCOS GABBRO

APPROXIMATE GEOLOGIC CONTACT OF UNITS QUERIED WHERE UNCERTAIN, DOTTED WHERE CONCEALED

APPROXIMATE LOCATION OF PREVIOUSLY SUSPECTED LANDSLIDE (CTE 8/12/03). HOWEVER, EXISTENCE NOT CONFIRMED; ACTUALLY EROSIONAL RELIC DUE TO DISSIMILAR BEDROCK IN COMBINATION WITH UNCONTROLLED GRADING

A A' GEOLOGIC CROSS SECTION

SL-1 APPROXIMATE SEISMIC LINE LOCATION

STL 1 APPROXIMATE STING LINE LOCATION

NOTE: SOURCE DRAWING FROM HALE ENGINEERING

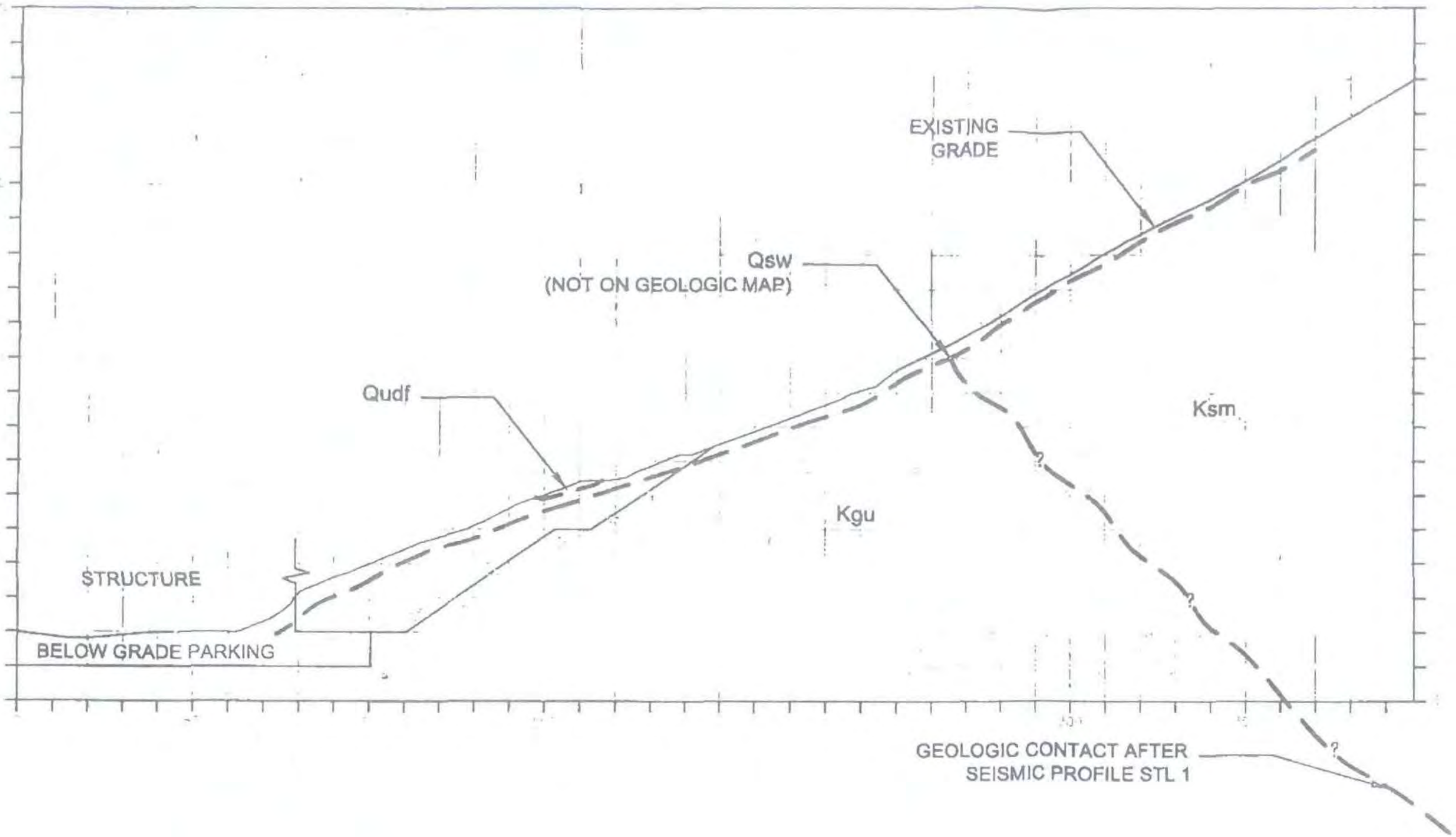
CONSTRUCTION TESTING & ENGINEERING, INC.
PLANNING - CIVIL ENGINEERING - LAND SURVEYING - GEOTECHNICAL
1441 MONTIEL ROAD, SUITE 115 ESCONDIDO CA. 92026 PH (760) 746-4955

EXPLORATION LOCATION AND GEOLOGIC MAP
CANYON VILLAS AT THE CREEK
WELKS RESORT
COUNTY OF SAN DIEGO, CALIFORNIA

CTE JOB NO: 10-6349G	
SCALE: 1" = 80'	
DATE: 10/07	FIGURE: A

\\Cte_server\projects\10-6001 to 10-7000 Projects\10-6349\FIG 1.dwg 10/16/2007 7:15:37 AM PDT

\\Cte_server\projects\10-6001 to 10-7000 Projects\10-6349\FIG 2.dwg 10/10/2007 8:29:11 AM PDT



EXPLANATION

QUATERNARY
- Qudf UNDOCUMENTED FILL
- Qsw SLOPE WASH NOT MAPPED ON FIGURE 1

CRETACEOUS
- Kgu UNDIFFERENTIATED GRANODIORITE
- Ksm SAN MARCOS GABBRO

DENSE CRYSTALLINE BEDROCK

VERY DENSE CRYSTALLINE BEDROCK SEISMIC VELOCITY>6,500 fps

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GEOLOGIC CROSS SECTION A-A'
CANYON VILLAS AT THE CREEK
WELKS RESORT
COUNTY OF SAN DIEGO, CALIFORNIA

CTE JOB NO: 10-6349G
SCALE: 1" = 40'
DATE: 10/07
FIGURE: 8

APPENDIX 1

REFERENCES CITED

REFERENCES CITED

1. Construction Engineering and Testing, Inc., July 9, 2003 "Evaluation of Potential Rockfall Hazards, Proposed Canyon Villas, TM 5313/REZ 03-004STP 03-029/ENV #79-08-099-A, Lawerence Welk Resort, Escondido, California" project number 10-6349.

2. Construction Engineering and Testing, Inc., August 12, 2003 "Geotechnical Feasibility Study, Proposed Canyon Villas at the Welk Resort, TM 5313/REZ 03-029/ENV #79-08-099-A., Welk View Drive, Escondido, California" project numbers 10-6305 & 10-6349.

3. Hale Engineering., January 21, 2004, revision 4 (latest) August 17, 2007 "Preliminary Grading Plan, Canyon Villas at the Welk Resort" project number 0247.

4. Jennings, C.W., 1997, "Geologic Map of California."

5. Jennings, C. W., 1987, "Fault Map of California with Locations of Volcanoes, Thermal Springs and Thermal Wells."

6. Johns, R.H. (ed.), 1954, "Geology of Southern California" California Division of Mines, Bulletin 170.

7. Kennedy, M.P., 1999, "Geologic Map of the Valley Center 7.5 Minute Quadrangle, San Diego County" scale 1"=2,000' United States Geological Survey and California Division of Mines and Geology.

8. Weber, F. jr., 1963, "Geology and Mineral Resources of San Diego County, California" California Division of Mines and Geology, County Report 3.

9. County of San Diego, January 23, 2007 "Third Screencheck Review of Draft Supplemental Environmental Impact Report (SEIR), page 6, EIR Format and Content Review, not 5".

10. Aerial Photograph T-2-SDC, dated 12-14-60, negative production from County of San Diego Department of Public Works.

APPENDIX 2

EXPLORATION LOGS

CONSTRUCTION TESTING & ENGINEERING, INC.

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DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS < 5% FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS OR GRAVEL SAND MIXTURES, LITTLE OF NO FINES
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS < 5% FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, SLIGHTLY PLASTIC CLAYEY SILTS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, SILTS OR LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTY CLAYS
HIGHLY ORGANIC SOILS			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

GRAIN SIZES

BOULDERS	COBBLES	GRAVEL		SAND			SILTS AND CLAYS
		COARSE	FINE	COARSE	MEDIUM	FINE	

12" 3" 3/4" 4 10 40 200

CLEAR SQUARE SIEVE OPENING U.S. STANDARD SIEVE SIZE

ADDITIONAL TESTS

(OTHER THAN TEST PIT AND BORING LOG COLUMN HEADINGS)

MAX- Maximum Dry Density
GS- Grain Size Distribution
SE- Sand Equivalent
EI- Expansion Index
CHM- Sulfate and Chloride Content , pH, Resistivity
COR - Corrosivity
SD- Sample Disturbed

PM- Permeability
SG- Specific Gravity
HA- Hydrometer Analysis
AL- Atterberg Limits
RV- R-Value
CN- Consolidation
CP- Collapse Potential
HC- Hydrocollapse
REM- Remolded

PP- Pocket Penetrometer
WA- Wash Analysis
DS- Direct Shear
UC- Unconfined Compression
MD- Moisture/Density
M- Moisture
SC- Swell Compression
OI- Organic Impurities

CONSTRUCTION TESTING & ENGINEERING, INC.

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PROJECT:	DRILLER:	SHEET: of
CTE JOB NO:	DRILL METHOD:	DRILLING DATE:
LOGGED BY:	SAMPLE METHOD:	ELEVATION:

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	BORING LEGEND DESCRIPTION	Laboratory Tests
0								Block or Chunk Sample	
								Bulk Sample	
5									
								Standard Penetration Test	
10								Modified Split-Barrel Drive Sampler (Cal Sampler)	
								Thin Walled Army Corp. of Engineers Sample	
15								Groundwater Table	
								Soil Type or Classification Change	
20								? —— ? —— ? —— ? —— ? —— ? —— ? —	
								Formation Change [(Approximate boundaries queried (?)]	
25						"SM"		Quotes are placed around classifications where the soils exist in situ as bedrock	

FIGURE: BL2

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GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION

1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746 4955

PROJECT: WELK RESORT CANYON VILLAS	EXCAVATOR: JD555 TRACK MOUNTED BACKHOE		
CTE JOB NO: 10-6349G	EXCAVATION METHOD: 24" BUCKET	EXCAVATION DATE:	9/20/2007
LOGGED BY: GFR	SAMPLING METHOD: BULK	ELEVATION:	-

TEST PIT LOG: TP-1

Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	Depth (Feet)	Sample Type: Bulk	Sample Type: Driven	DESCRIPTION	Laboratory Tests
		SM		0			SLOPEWASH: Loose, dry, brown, silty fine to medium SAND, numerous roots.	
		SM					UNDIFFERENTIATED GRANODIORITE: Dense, dry, red brown, fine to medium grained crystalline rock. Excavates as silty fine to coarse SAND. Very dense difficult to excavate at 7 feet.	
				5				
							No Caving Refusal at 7' No Groundwater Backfilled 9/20/07	
				10				
				15				

FIGURE: TP-1

CONSTRUCTION TESTING & ENGINEERING, INC.

GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION

PROJECT:	WELK RESORT CANYON VILLAS	EXCAVATOR:	JD555 TRACK MOUNTED BACKHOE		
CTE JOB NO:	10-6349G	EXCAVATION METHOD:	24" BUCKET	EXCAVATION DATE:	9/20/2007
LOGGED BY:	GFR	SAMPLING METHOD:	BULK	ELEVATION:	-

TEST PIT LOG: TP-2

Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	Depth (Feet)	Sample Type: Bulk	Sample Type: Driven	DESCRIPTION	Laboratory Tests
		SM		0			UNDOCUMENTED FILL: Loose, dry, light brown, silty fine to medium SAND.	
					X		UNDIFFERENTIATED GRANODIORITE: Dense, dry, red brown, medium to coarse, crystalline rock, very weathered. Excavates as silty fine to coarse SAND.	MAX, DS
				5				
		SM					Very dense, dry, brown, fine to medium grained. Very difficult to excavate at 10 feet.	
				10			No Caving Refusal at 10' No Groundwater Backfilled 9/20/07	
				15				

FIGURE: TP-2

CONSTRUCTION TESTING & ENGINEERING, INC.
GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION

PROJECT:	WELK RESORT CANYON VILLAS	EXCAVATOR:	JD555 TRACK MOUNTED BACKHOE		
CTE JOB NO:	10-6349G	EXCAVATION METHOD:	24" BUCKET	EXCAVATION DATE:	9/20/2007
LOGGED BY:	GFR	SAMPLING METHOD:	BULK	ELEVATION:	-

TEST PIT LOG: TP-3

Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	Depth (Feet)	Sample Type: Bulk	Sample Type: Driven	DESCRIPTION	Laboratory Tests
				0				
		SM					SLOPEWASH: Loose, dry, brown, silty fine to medium SAND, numerous roots.	
		SM					SAN MARCOS GABBRO: Dense, dry, gray to dark white, fine to medium crystalline rock, weathered. Excavates as silty fine to medium SAND.	
				5				
							Very dense. Very difficult to excavate at 8 feet.	
							No Caving Refusal at 8' No Groundwater Backfilled 9/20/07	
				10				
				15				

FIGURE: TP-3

CONSTRUCTION TESTING & ENGINEERING, INC.

GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION

PROJECT: WELK RESORT CANYON VILLAS	EXCAVATOR: JD555 TRACK MOUNTED BACKHOE		
CTE JOB NO: 10-6349G	EXCAVATION METHOD: 24" BUCKET	EXCAVATION DATE:	9/20/2007
LOGGED BY: GFR	SAMPLING METHOD: BULK	ELEVATION:	-

TEST PIT LOG: TP-4

Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	Depth (Feet)	Sample Type: Bulk	Sample Type: Driven	DESCRIPTION
				0			SLOPEWASH:
		SM					Loose, dry, brown, silty fine to medium SAND.
		SM					UNDIFFERENTIATED GRANODIORITE AND SAN MARCOS GABBRO: Dense, dry, red brown, fine to medium crystalline rock. Excavates as silty fine to medium SAND. Contains inclusions up to 4 feet in maximum exposed dimension of San Marcos Gabbro. Very dense, difficult to excavate at 8 feet.
				5			
							No Caving Refusal at 8' No Groundwater Backfilled 9/20/07
				10			
				15			

APPENDIX 3

GEOPHYSICAL REPORT

GEOPHYSICAL SURVEY
PROPOSED RESIDENTIAL DEVELOPMENT
ESCONDIDO, CALIFORNIA

PREPARED FOR:
Construction Testing & Engineering, Inc.
1441 Montiel Road, Suite 115
Escondido, California 92026

PREPARED BY:
Southwest Geophysics, Inc.
7438 Trade Street
San Diego, California 92121

September 28, 2007
Project No. 107198

SOUTHWEST
GEOPHYSICS, INC.
YOUR SUBSURFACE SOLUTION

September 28, 2007
Project No. 107198

Mr. Greg Rzonca
Construction Testing & Engineering, Inc.
1441 Montiel Road, Suite 115
Escondido, California 92026

Subject: Geophysical Survey
Proposed Residential Development
Escondido, California

Dear Mr. Rzonca:

In accordance with your authorization, we have performed geophysical survey services for the proposed residential development to be located just north of Welk View Drive, in Escondido, California. Specifically, our survey consisted of performing three seismic refraction lines and one Sting resistivity line at the subject site. The purpose of our study was to develop a subsurface profile of the areas surveyed, and to assess the apparent rippability of near surface materials. This data report presents our survey methodology, equipment used, analysis, and results.

We appreciate the opportunity to be of service on this project. Should you have any questions related to this report, please contact the undersigned at your convenience.

Sincerely,
SOUTHWEST GEOPHYSICS, INC.

Patrick Lehrmann

Patrick Lehrmann, P.G., R.Gp.
Principal Geologist/Geophysicist

Hans van de Vrugt

Hans van de Vrugt, C.E.G., R.Gp.
Principal Geologist/Geophysicist

REGISTERED GEOPHYSICIST
Hans van de Vrugt
No 1012
Exp. 2/29/08
STATE OF CALIFORNIA

PFL/HV/hv

Distribution: Addressee (electronic)

TABLE OF CONTENTS

1. INTRODUCTION

In accordance with your authorization, we have performed geophysical survey services for the proposed residential development to be located just north of Welk View Drive, in Escondido, California (Figure 1). Specifically, our survey consisted of performing three seismic refraction lines and one Sting resistivity line at the subject site (Figure 2). The purpose of our study was to develop a subsurface profile of the areas surveyed, and to assess the apparent rippability of near surface materials. This data report presents the survey methodology, equipment used, analysis, and findings.

2. SCOPE OF SERVICES

Our scope of services included:

- Review of a site plan provided by your office.
- Performance of three seismic refraction profiles.
- Performance of one high resolution resistivity (Sting) traverse.
- Compilation and geophysical analysis of the data collected.
- Preparation of this data report presenting our findings and conclusions.

3. SITE AND PROJECT DESCRIPTION

In general, the study area included undeveloped land consisting of steep to moderately steep slopes (Figures 1 and 2). Vegetation in this area generally consists of sage brush, annual grass, and small trees. Figure 3 provides a general view of the site conditions along the seismic refraction and Sting lines.

Based on our discussions with you, we understand that the study area is under consideration for grading and construction of new condominiums and associated roadways. Cuts up to 60 feet deep in the study area are proposed.

4. SURVEY METHODOLOGY

In order to characterize the subsurface materials, seismic refraction and Sting profiles were conducted in slope areas pre-selected by your office. Figure 2 illustrates the general location of the profiles. Prior to conducting the profiles a relatively small area along the survey line was "brushed" in order to facilitate the installation of electrodes and sensors. The following sections provide an overview of the seismic refraction and Sting methods used for the study.

4.1. Seismic Refraction Survey

Seismic P-wave (compression wave) refraction traverses were conducted at the site to evaluate the depth to bedrock and apparent rippability characteristics of the subsurface materials, and to develop a subsurface velocity profile of the areas surveyed. The seismic refraction method uses first-arrival times of refracted seismic waves to characterize the velocity structure of the subsurface materials. Seismic P-waves were generated at the surface using a hammer and plate. The refracted seismic waves were then detected by a series of surface vertical component geophones, and recorded with a 24-channel Geometrics Strata-View seismograph. The travel times of the seismic P-waves were used in conjunction with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials. Three seismic lines/profiles were conducted at the site (SL-1 through SL-3). The locations of the lines are depicted on Figure 2. Shot points were conducted at each end of the line and between geophones 6 and 7, 12 and 13, and 18 and 19. The profiles were 240 feet long. Processing of the data was performed using SIPwin V2.76.

The refraction method requires that subsurface velocities increase with depth. A layer having a velocity lower than that of the layer above will not be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. In addition, lateral variations in velocity, such as those caused by core stones, can also result in the misinterpretation of the subsurface conditions.

In general, seismic wave velocities can be correlated to material density and/or rock hardness. The relationship between rippability and seismic velocity is empirical and assumes a homogenous mass. Localized areas of differing composition, texture, and/or structure may affect both the measured data and the actual rippability of the mass. The rippability of a mass is also dependent on the excavation equipment used and the skill and experience of the equipment operator.

The rippability values presented in Table 1 are based on our experience with similar materials and assumes that a Caterpillar D-9 dozer ripping with a single shank is used. We emphasize that the cutoffs in this classification scheme are approximate and that rock characteristics, such as fracture spacing and orientation, play a significant role in determining rock rippability. These characteristics may also vary with location and depth.

For trenching operations, the rippability values should be scaled downward. For example, velocities as low as 3,500 feet/second may indicate difficult ripping during trenching operations. In addition, the presence of boulders, which can be troublesome in a narrow trench, should be anticipated.

Table 1 – Rippability Classification	
Seismic P-wave Velocity	**Rippability**
0 to 2,000 feet/second	Easy
2,000 to 4,000 feet/second	Moderate
4,000 to 5,500 feet/second	Difficult, Possible Local Blasting
5,500 to 7,000 feet/second	Very Difficult, Probable Local to General Blasting
Greater than 7,000 feet/second	Blasting Generally Required

It should be noted that the rippability cutoffs presented in Table 1 are slightly more conservative than those published in the Caterpillar Performance Handbook (Caterpillar, 2004). Accordingly, the above classification scheme should be used with discretion, and contractors should not be relieved of making their own independent evaluation of the rippability of the on-site materials prior to submitting their bids.

4.2. Sting Resistivity Survey

As previously discussed, a high resolution resistivity survey was also conducted at the site to evaluate the subsurface geologic conditions. The resistivity data were collected with an AGI Super Sting R8 resistivity meter. As depicted on Figure 2, the resistivity survey was conducted near the central portion of the site along seismic line SL-2.

The resistivity line (STL-1) consisted of 56 electrodes, with an electrode spacing of approximately 5 feet. The spread extended roughly 275 feet across the site. The electrodes were driven roughly 8 inches in to the bottom of potholes, which were excavated 6 to 12 inches deep. The area around the electrode was then moistened with salt water in order to improve connectivity. The data was collected using the Dipole-Dipole configuration. The data set was processed using a two-dimensional resistivity modeling algorithm. The results were then integrated into a color resistivity model section.

5. RESULTS

Table 2 lists the approximate P-wave velocities and depths calculated from the seismic refraction traverses conducted during the evaluation. The approximate locations of the seismic refraction traverses are shown on the Line Location Map (Figure 2). The layer velocity profiles are included in Figures 4a through 4c. It should also be noted that, as a general rule, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth the length of the refraction line. The results of the Sting survey are presented in Figure 5. The results are shown in Ohm meters.

Table 2 – Seismic Traverse Results

Traverse No. And Length	P-wave Velocity feet/second	Approximate Depth to Bottom of Layer in feet	Apparent Rippability*
SL-1 240 feet	V1 = 1,550 V2 = 4,100	1 – 10 ---	Easy Difficult, Possible Blasting
SL-2 240 feet	V1 = 1,850 V2 = 3,050 V3 = 6,700	2 – 10 27 – 64 ---	Easy Moderate Very Difficult, Probable Blasting
SL-3 240 feet	V1 = 1,500 V2 = 3,250 V3 = 7,350	1 – 6 20 – 44 ---	Easy Moderate Blasting Generally Required

* Rippability criteria based on the use of a Caterpillar D-9 dozer ripping with a single shank

6. CONCLUSIONS

The results from our seismic survey revealed two to three layers/horizons at the locations surveyed. Based on our site observations and discussions with you, the layers detected have been interpreted to be surficial soil (colluvium or topsoil) overlying varying degrees of weathered granitic rock. Figures 4a through 4c provide the layer profiles for the areas surveyed and the corresponding velocities calculated for each layer. Based on the results of our survey, significant lateral variations in the subsurface materials are present in the study area. Accordingly, variability in the excavatability (including excavation depth) of the subsurface materials should be expected across the project area. It should also be noted that our general depth of exploration is on the order of 50 to 60 feet; therefore, higher velocity material should be expected beyond this depth.

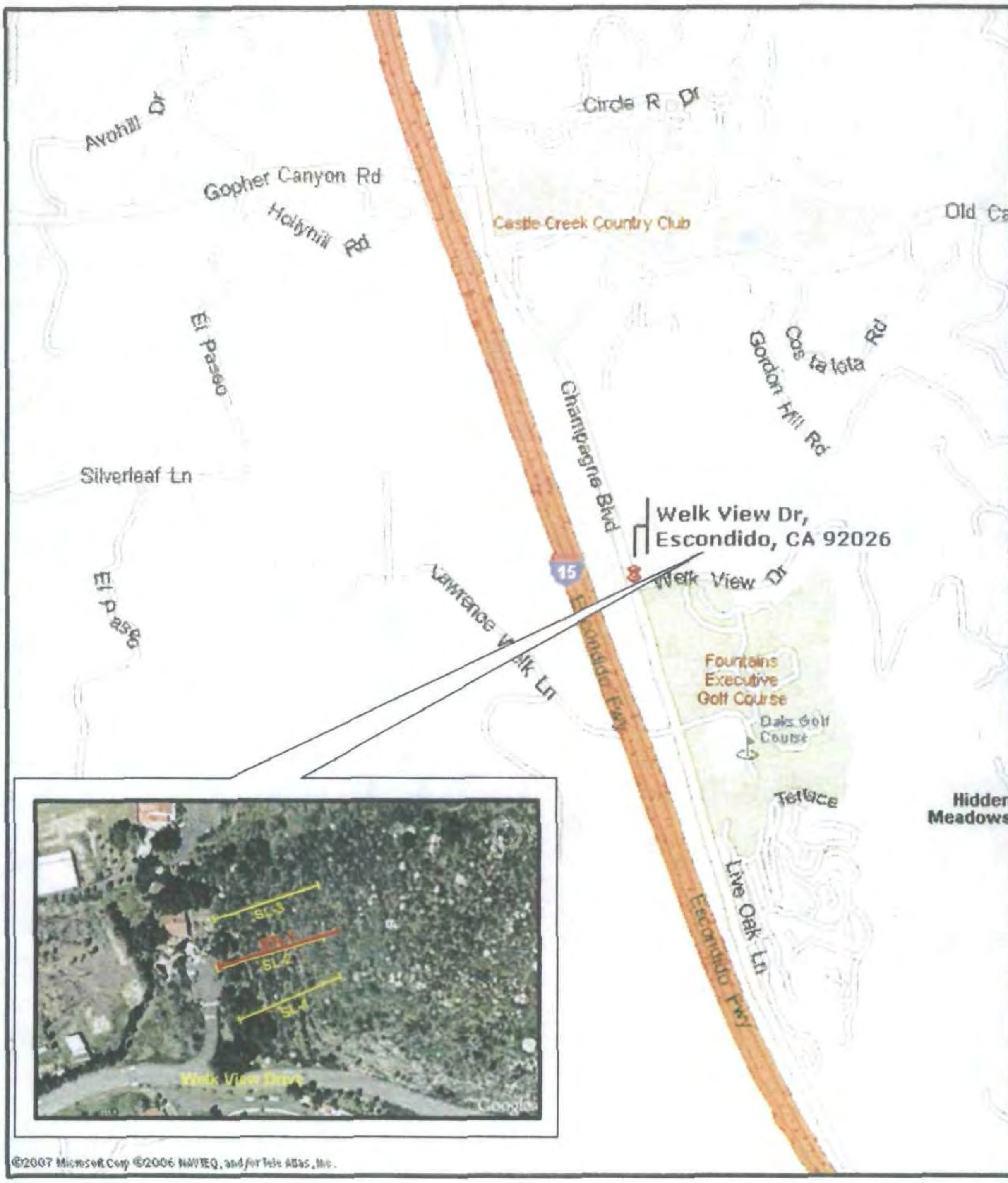
Based on our results, difficult conditions where blasting may be required to obtain proposed excavation depths may be encountered depending on the location, excavation depth, and desired rate of production. A contractor with excavation experience in similar difficult conditions should be consulted for expert advice on excavation methodology, equipment, production rate, and possibly oversized materials.

The Sting results indicate that the subsurface materials are somewhat irregular with regard to their electrical properties as evident by the presence of resistive and conductive pockets. In addition, more resistive material is present in the near surface, especially along the central and western portions of the site. This highly resistive material is likely due to the presence loose surficial soils and possible boulders.

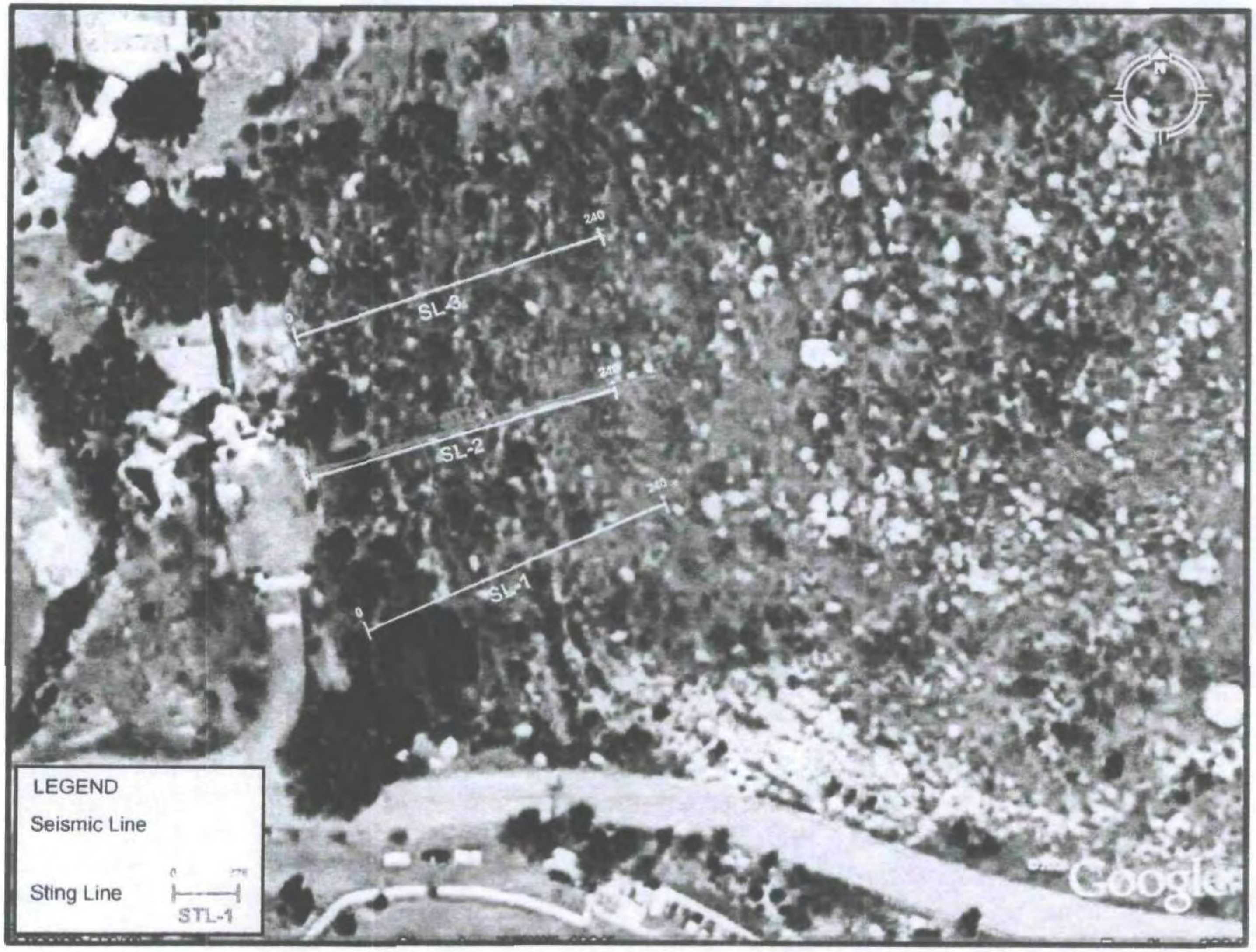
7. LIMITATIONS

The field evaluation and geophysical analyses presented in this report have been conducted in general accordance with current practice and the standard of care exercised by consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be present. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface surveying will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Southwest Geophysics, Inc. should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document. This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

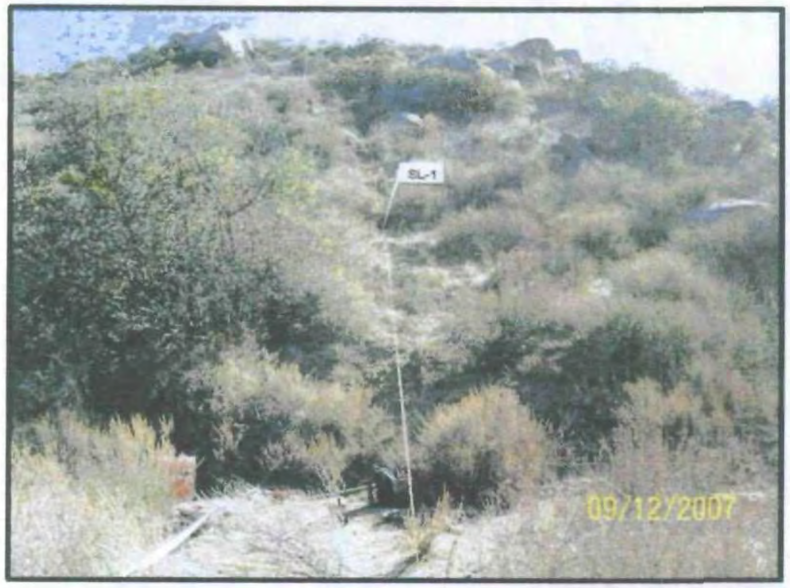


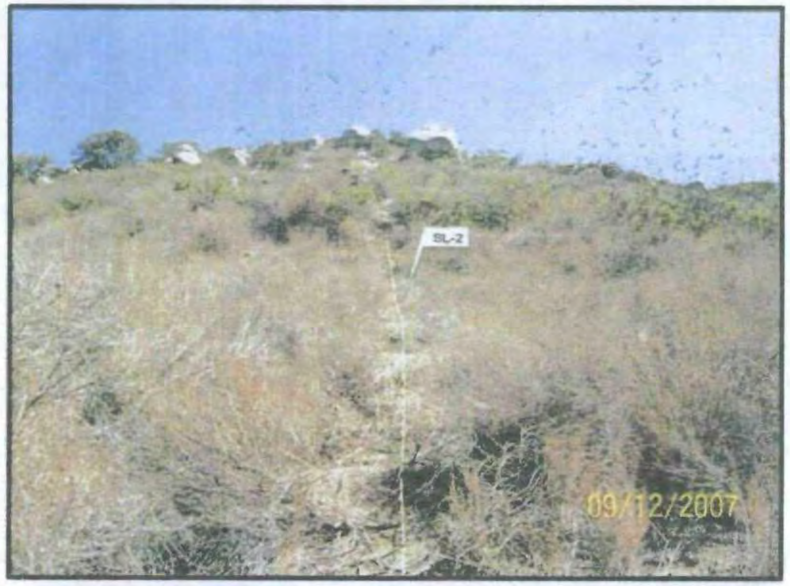
SITE LOCATION MAP	N	Proposed Residential Development Escondido, California Project No.: 107198 — Date: 09/07	SOUTHWEST GEOPHYSICS INC Figure 1

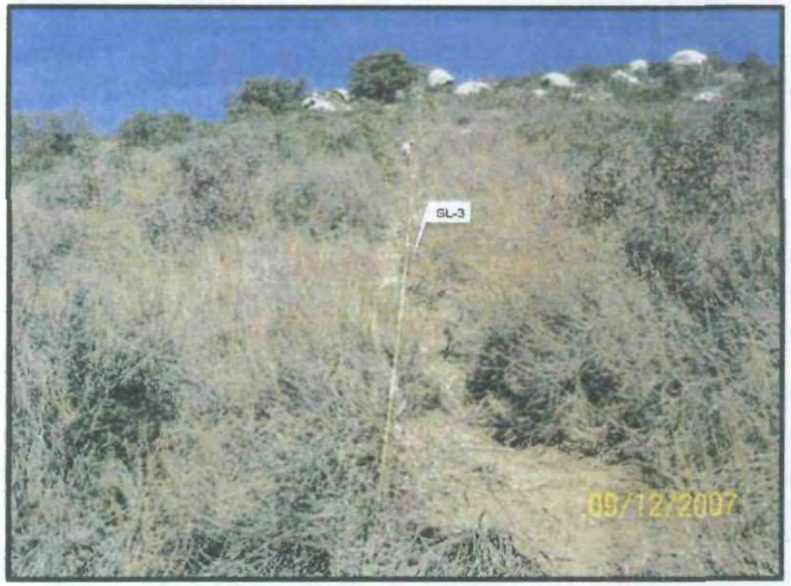


SEISMIC LINE LOCATION MAP	N	Proposed Residential Development Escondido, California	SOUTHWEST GEOPHYSICS INC. Figure 2
		Project No.: 107198 / Date 09/07	

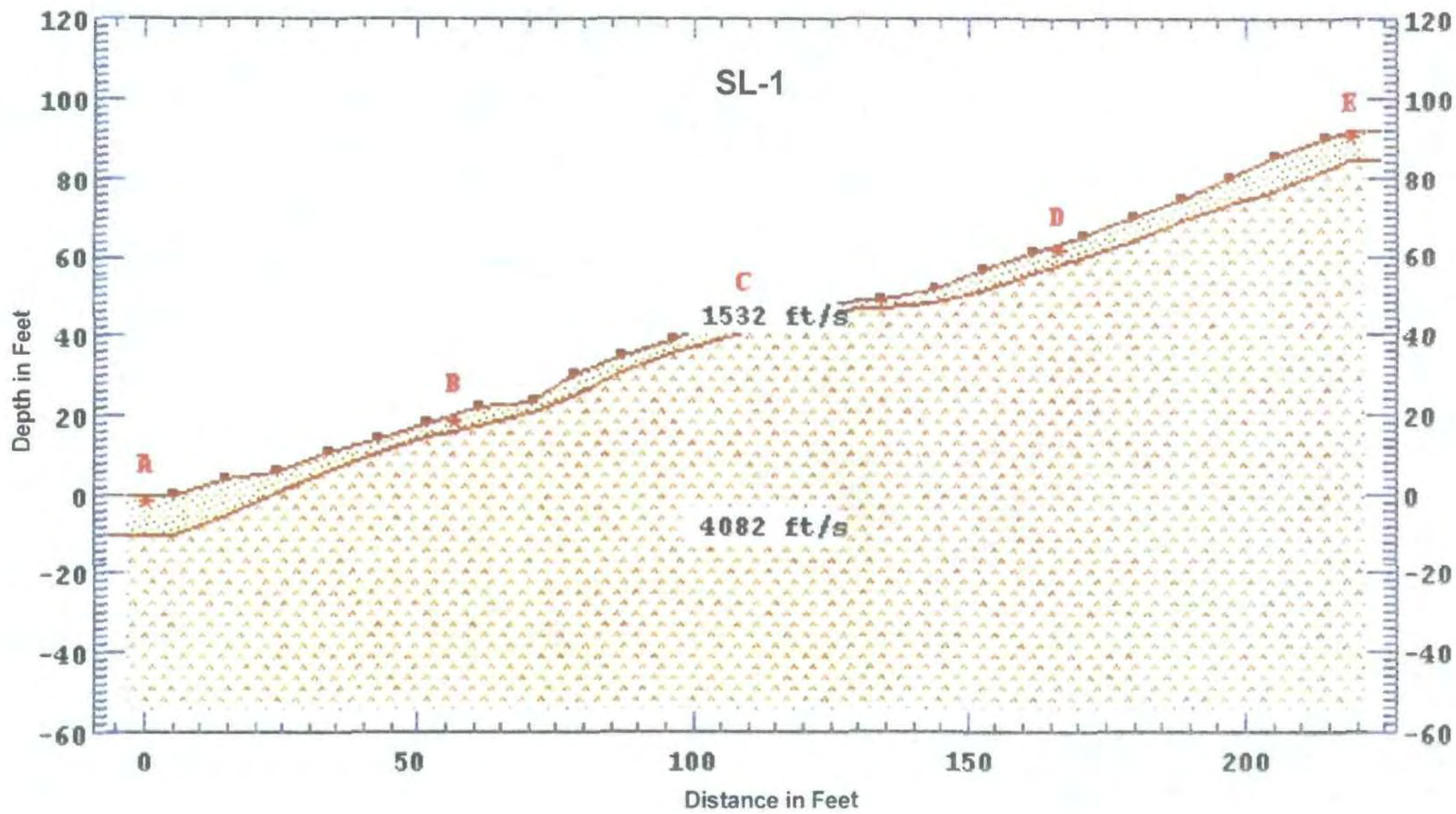
0 100 200
approximate scale in feet



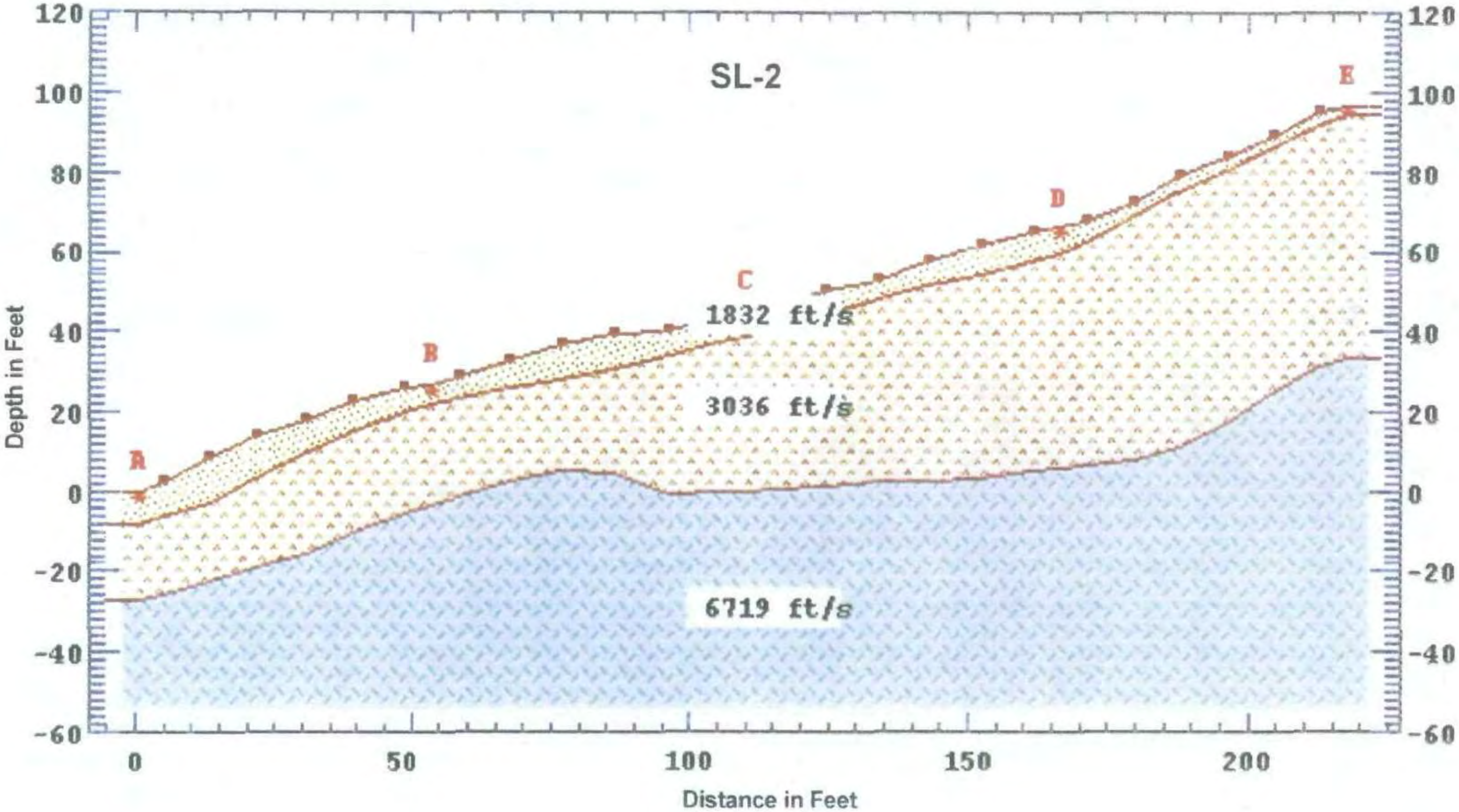




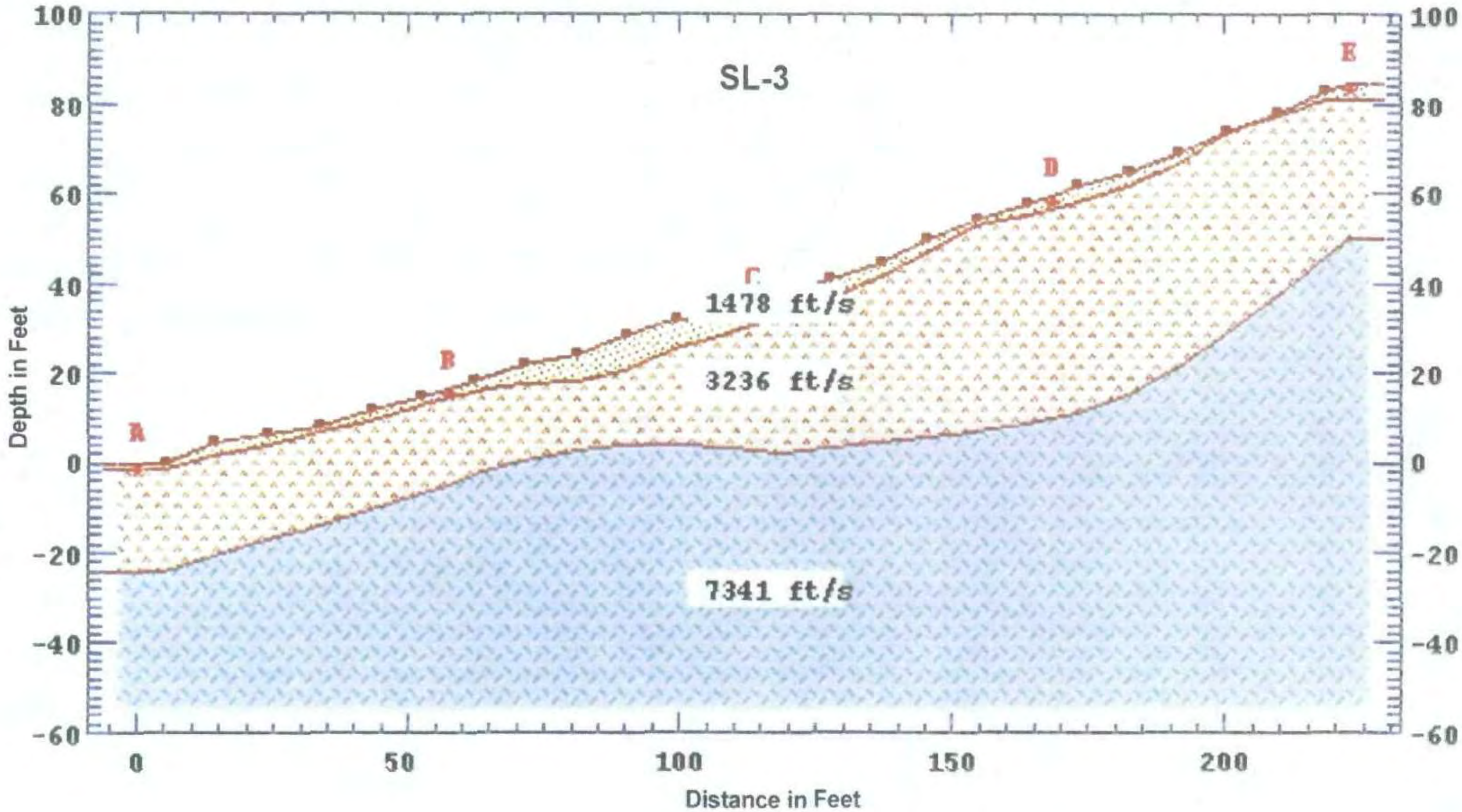
SITE PHOTOGRAPHS	Proposed Residential Development Escondido, California Project No.: 107198 Date: 09/07	SOUTHWEST GEOPHYSICS INC Figure 3



SEISMIC PROFILE SL-1	Proposed Residential Development Escondido, California Project No.: 107198 Date: 09/07	SOUTHWEST GEOPHYSICS INC. Figure 4a

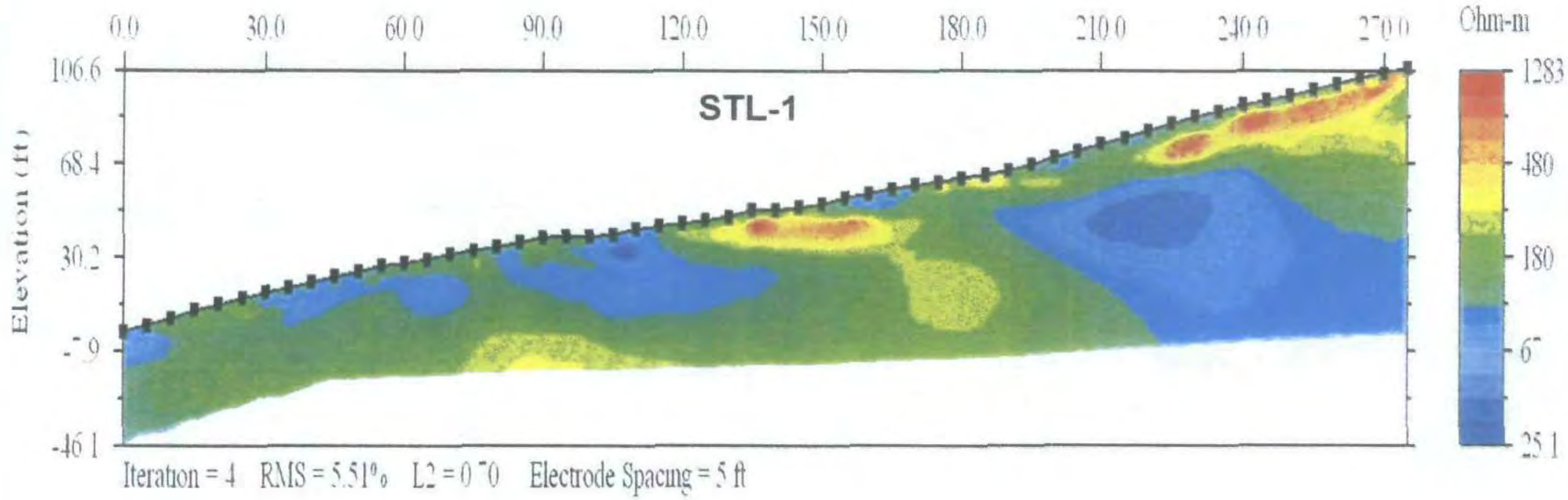


SEISMIC PROFILE SL-2	Proposed Residential Development Escondido, California Project No.. 107198 · Date: 09/07	SOUTHWEST GEOPHYSICS INC Figure 4b



SEISMIC PROFILE SL-3	Proposed Residential Development Escondido, California	SOUTHWEST GEOPHYSICS INC
	Project No.: 107198 / Date: 09/07	Figure 4c

Inverted Resistivity Section



STING PROFILE STL-1	Proposed Residential Development Escondido, California Project No. 107198 — Date: 09/07	SOUTHWEST GEOPHYSICS INC Figure 5

APPENDIX 4

LABORATORY TEST RESULTS

APPENDIX D
LABORATORY METHODS AND RESULTS

Laboratory tests were performed on representative soil samples to detect their relative engineering properties. Tests were performed following test methods of the American Society for Testing Materials or other accepted standards. The following presents a brief description of the various test methods used. Laboratory results are presented in the following section of this Appendix.

Classification

Soils were classified visually according to the Unified Soil Classification System. Visual classifications were supplemented by laboratory testing of selected samples according to ASTM D2487.

Modified Proctor

Laboratory maximum dry density and optimum moisture content were performed according to ASTM D1557, Method A. A mechanically operated rammer was used during the compaction process.

Direct Shear

Direct shear tests were performed on either samples direct from the field or on samples recompacted to 90% of the laboratory maximum value overall. Direct shear testing was performed in accordance with ASTM D3080-04 to evaluate the shear strength characteristics of selected materials. The samples were inundated during shearing to represent adverse field conditions.

LABORATORY COMPACTION OF SOIL (MOD.)

ASTM D 1557

Project Name:	Canyon Villas at the Welk Resort	Tested By :	Joe M.	Date:	9/26/07
Project No.:	10-6349	Calculated By :	Joe M.	Date:	9/26/07
Lab No.:	17705	Sampled By:	Greg R.	Date:	9/21/07
Sample No. :	1	Depth (ft.)			
Sample Description:	DG W/ Light Brown Silty Sand				

Moisture Added (ml)	100	150	200	250	
TEST NO.	1	2	3	4	
Wt. Comp. Soil + Mold (g)	3918	3988	4059	4048	
Wt. of Mold (g)	1929	1929	1929	1929	
Net Wt. of Soil (g)	1989	2059	2130	2119	
Wet Wt. of Soil + Cont. (g)	220.8	219.1	215.7	231.8	
Dry Wt. of Soil + Cont. (g)	210.3	204.8	197.9	208.9	
Wt. of Container (g)	0.0	0.0	0.0	0.0	
Moisture Content (%)	5.0	7.0	9.0	11.0	
Wet Density (pcf)	132.5	137.1	141.9	141.1	
Dry Density (pcf)	126.2	128.2	130.2	127.2	

Preparation Method: Dry	X
Moist	
Mechanical Rammer	X
Manual Rammer	
Hammer Weight:	10.0 lb.
Drop:	18 in.
Mold Volume (ft.^{3}):	0.03310

PROCEDURE USED

X **Procedure A**

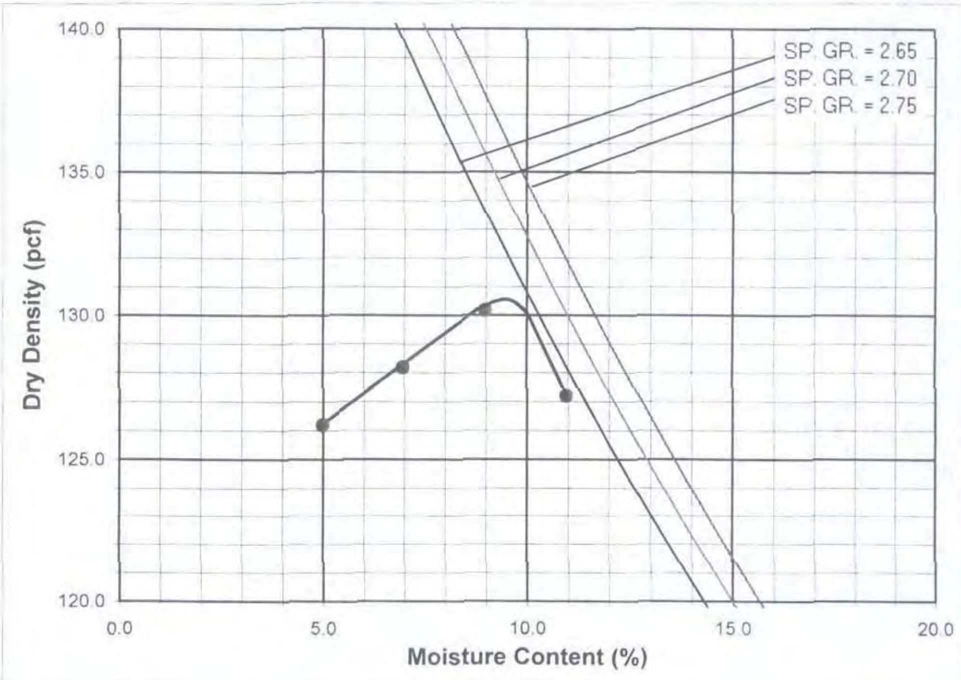
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if No.4 retained < 20%

Procedure B

Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 > 20% and + 3/8 " < 20%

Procedure C

Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if + 3/8 in >20% and + ¾ in <30%



OVERSIZE FRACTION

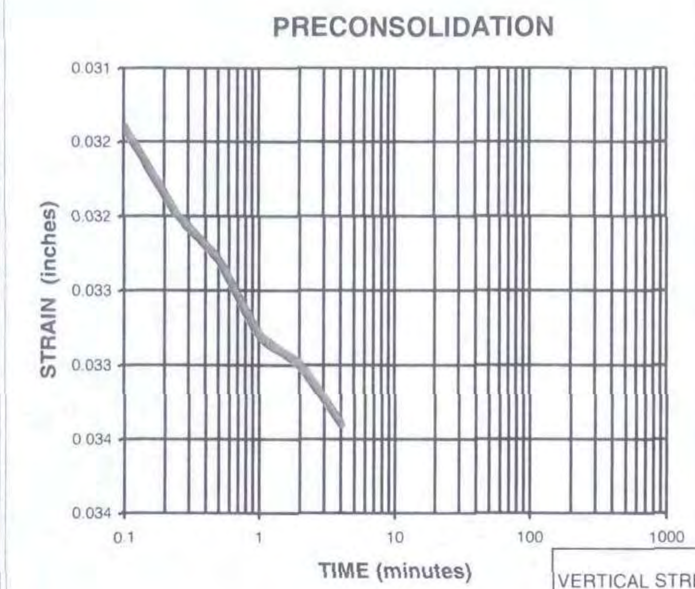
Total Sample Weight (g):

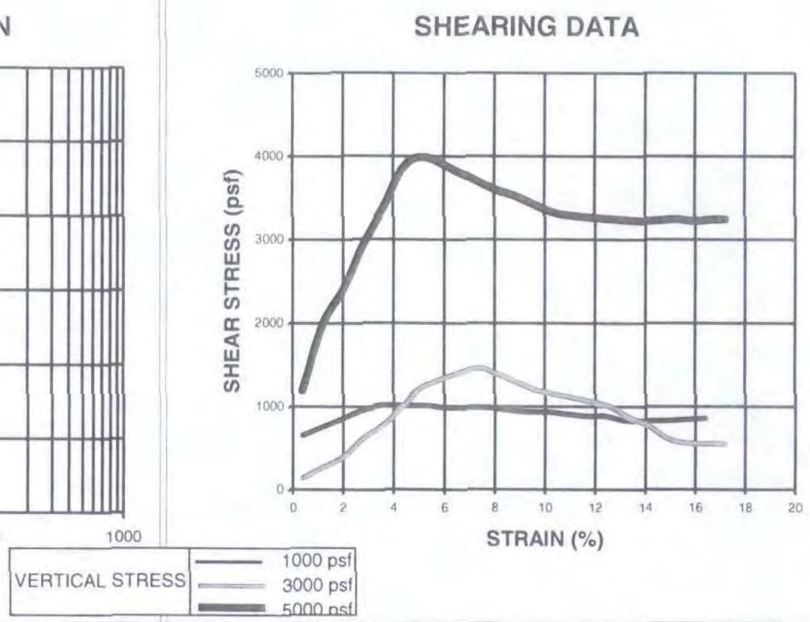
Weight Retained (g)		Percent Retained
	Plus 3/4"	N/A
	Plus 3/8"	N/A
	Plus #4	N/A

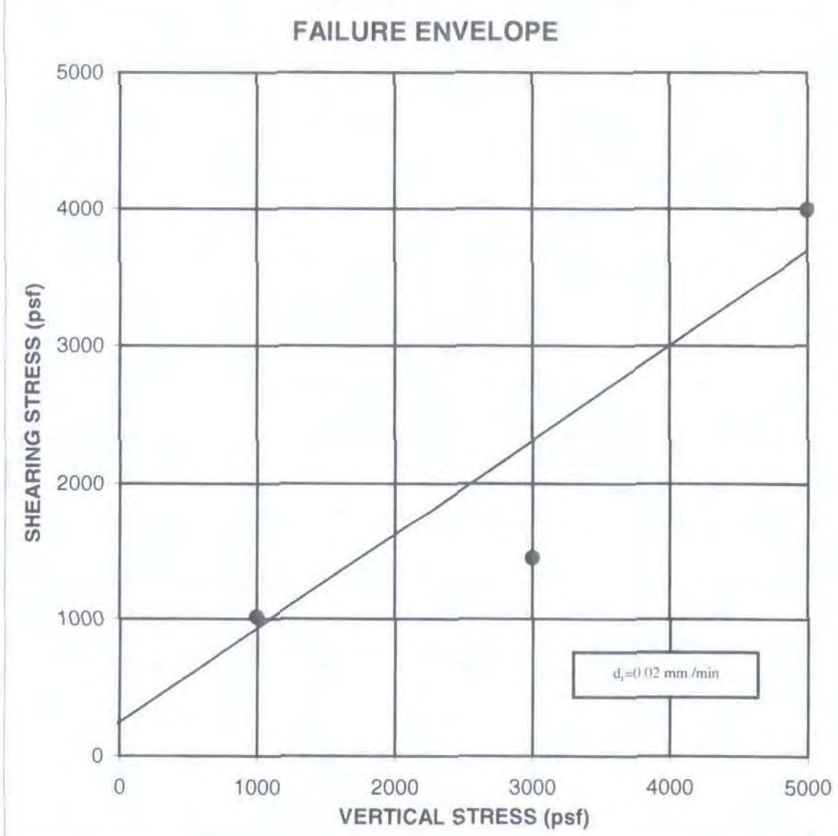
Maximum Dry Density (pcf)	130.5
Optimum Moisture Content (%)	9.5

Rock Correction Applied per ASTM D 4718

Maximum Dry Density (pcf)	**N/A**
Optimum Moisture Content (%)	**N/A**







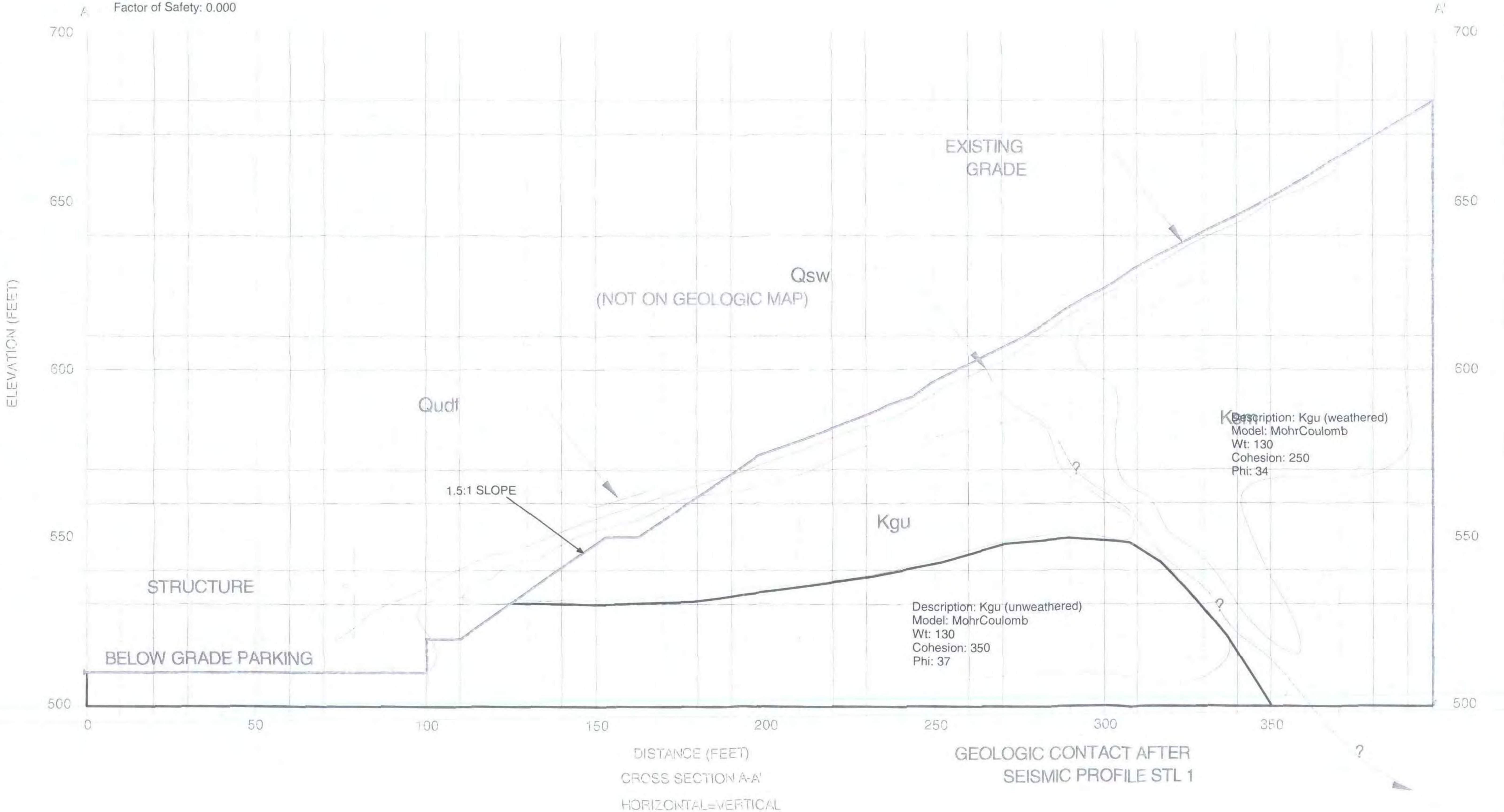
SHEAR STRENGTH TEST

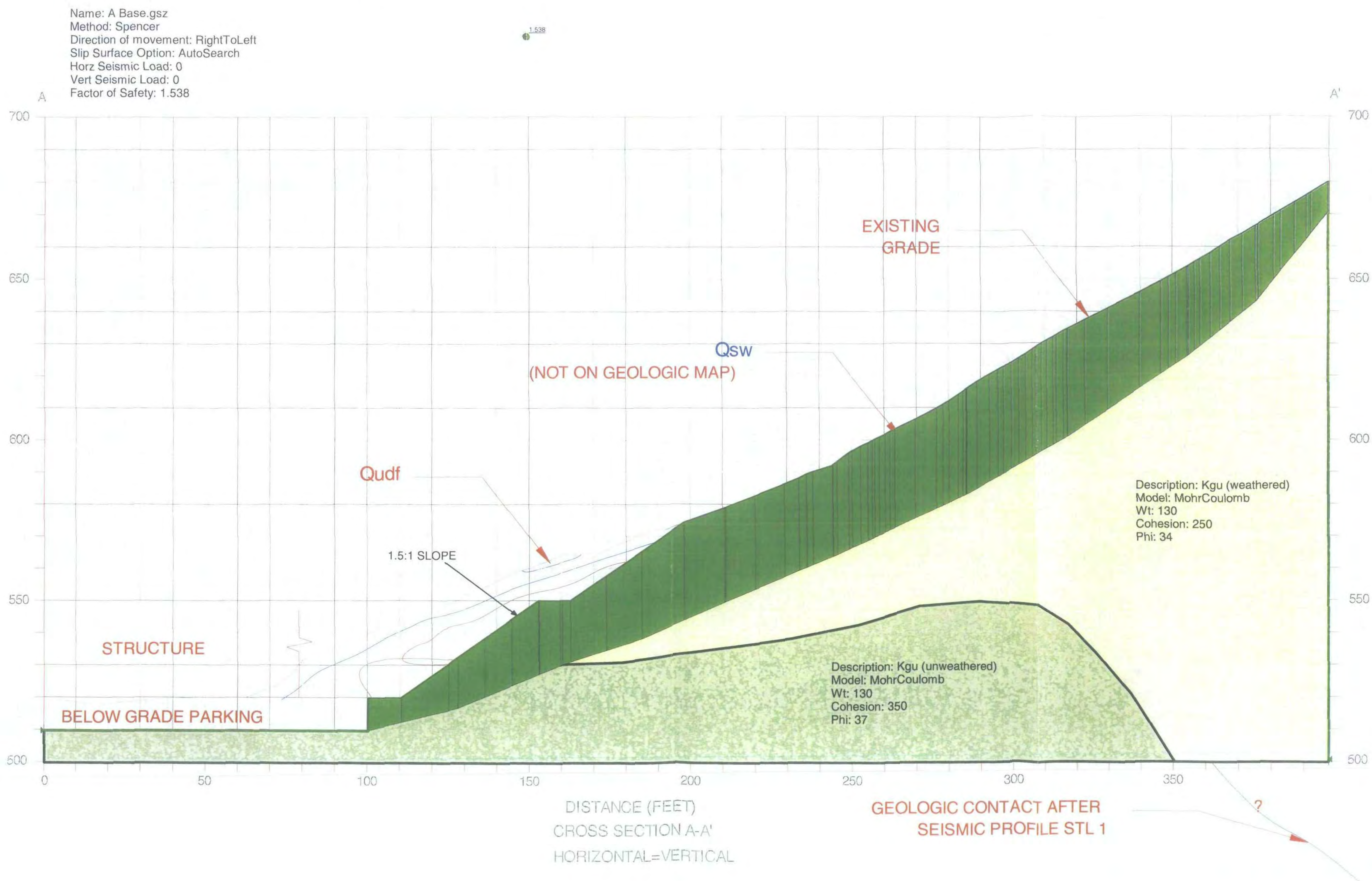
Sample Designation	Depth (ft)	Cohesion	Angle of Friction	Sample Description
TP-2	2-4	275 psf	34.0	SM, brown silty SAND (DG) (Remolded to 90% R.C.)
Initial Moisture (%):	9.5	Initial Dry Density (pcf)	117.5	CTE Job No: 10-6349
Final Moisture (%):	12.6			Lab No: 17705

APPENDIX 5

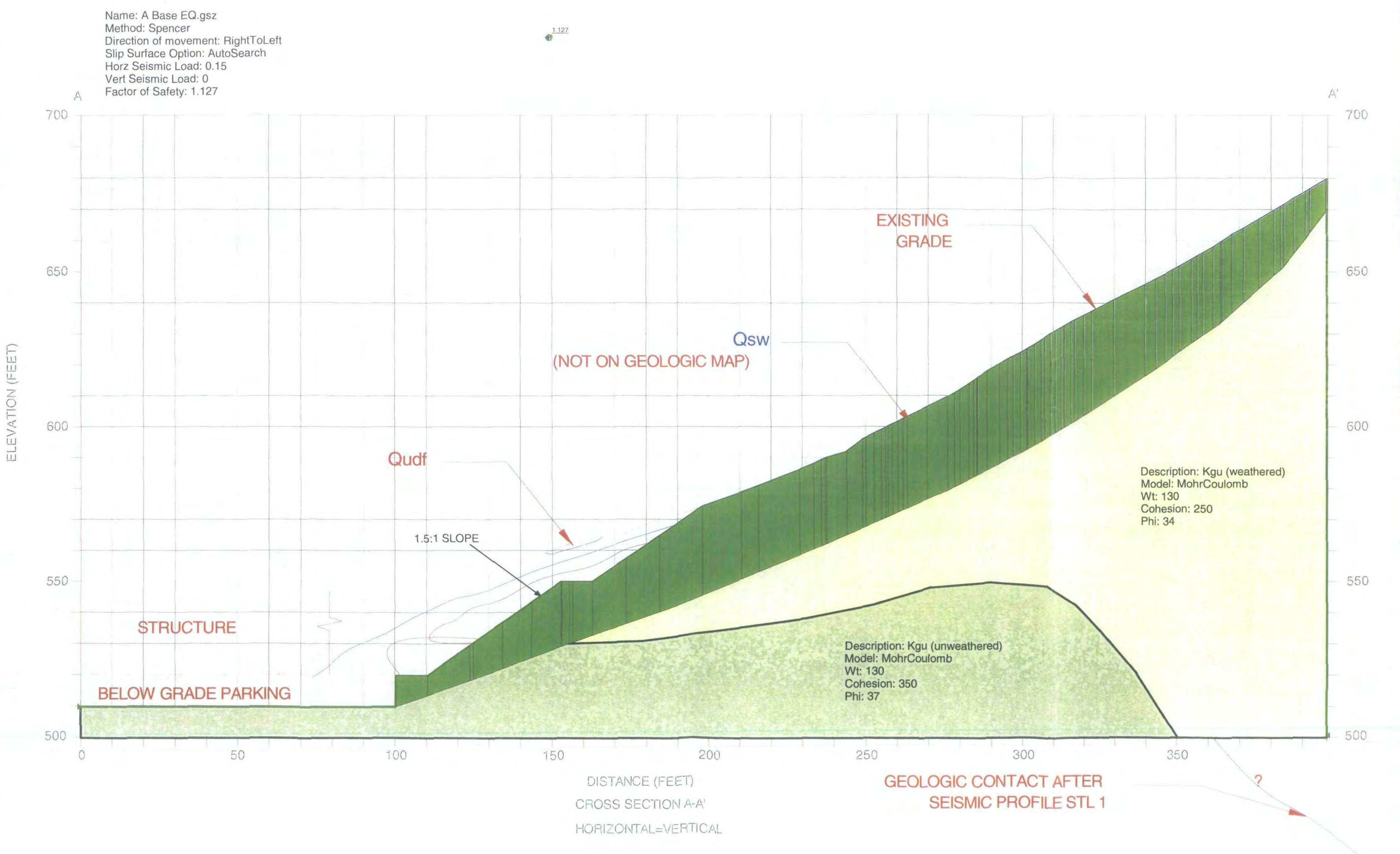
SLOPE STABILITY ANALYSES

Name: A Base.gsz
Method: Spencer
Direction of movement: RightToLeft
Slip Surface Option: AutoSearch
Horz Seismic Load: 0
Vert Seismic Load: 0
Factor of Safety: 0.000

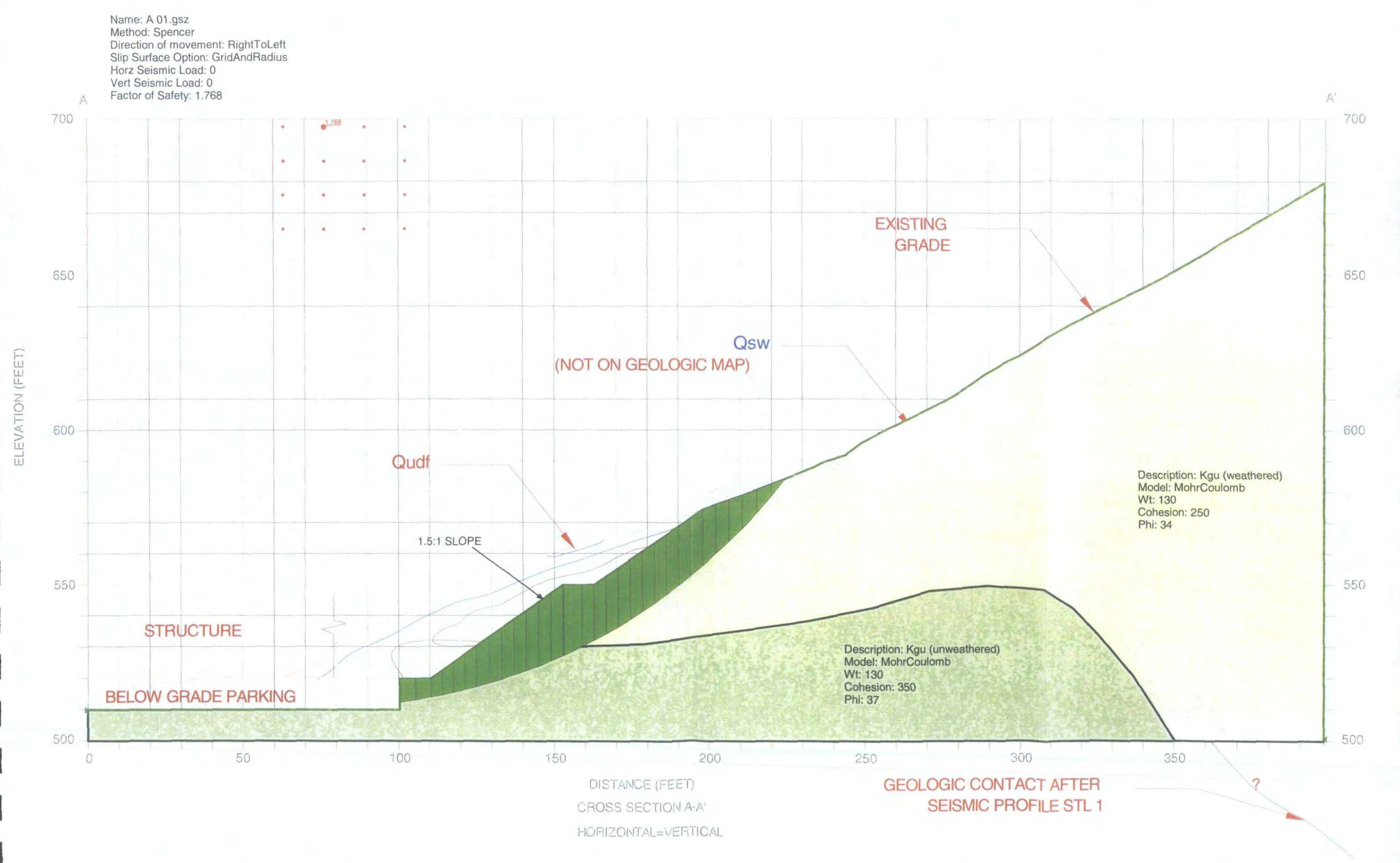




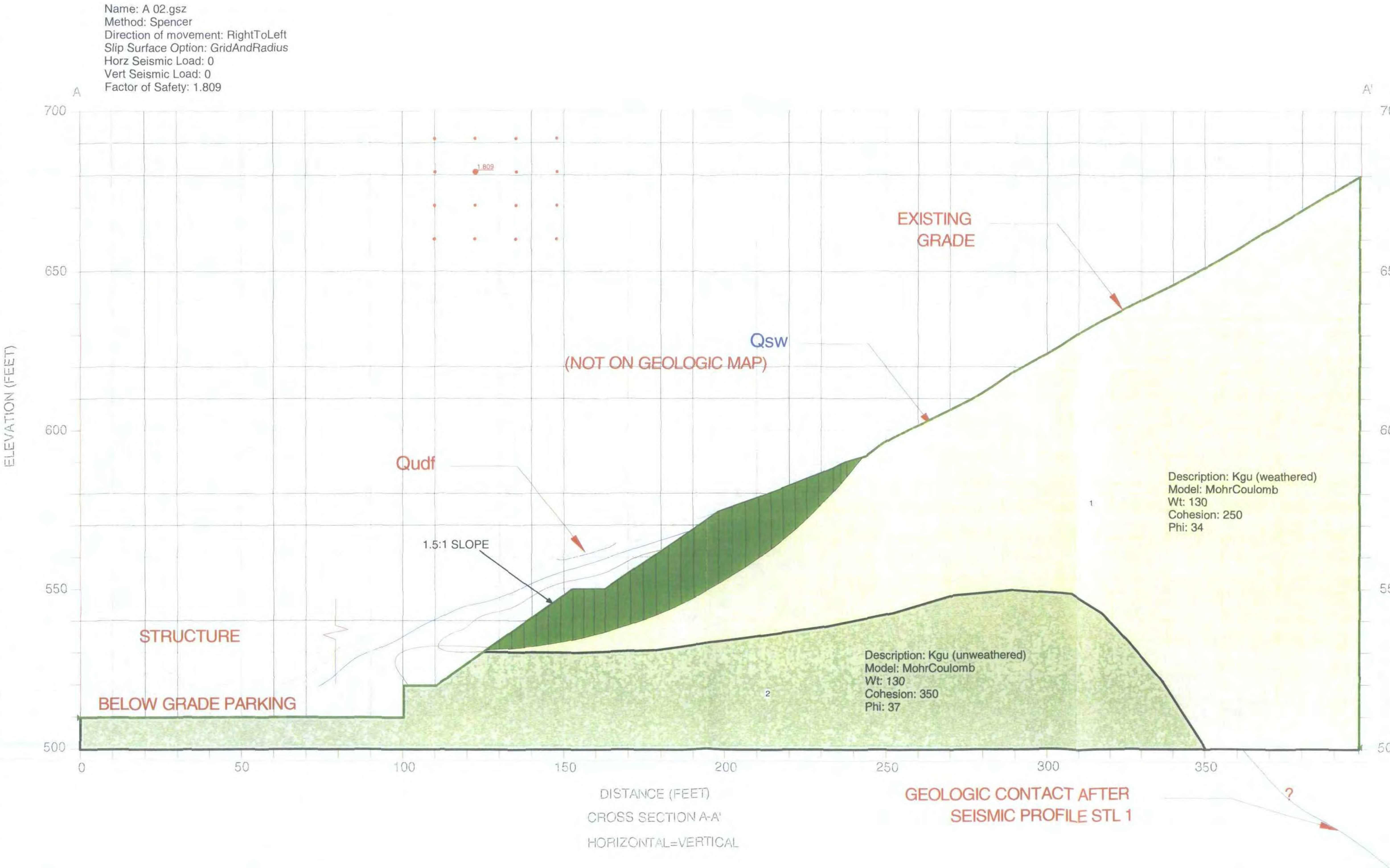
Name: A Base.gsz
Method: Spencer
Direction of movement: RightToLeft
Slip Surface Option: AutoSearch
Horz Seismic Load: 0
Vert Seismic Load: 0
Factor of Safety: 1.538
1.538
A
A'
700
650
600
550
500
ELEVATION (FEET)
EXISTING GRADE
Qsw
(NOT ON GEOLOGIC MAP)
Qudf
1.5:1 SLOPE
STRUCTURE
BELOW GRADE PARKING
Description: Kgu (weathered)
Model: MohrCoulomb
Wt: 130
Cohesion: 250
Phi: 34
Description: Kgu (unweathered)
Model: MohrCoulomb
Wt: 130
Cohesion: 350
Phi: 37
0
50
100
150
200
250
300
350
DISTANCE (FEET)
CROSS SECTION A-A'
HORIZONTAL=VERTICAL
GEOLOGIC CONTACT AFTER SEISMIC PROFILE STL 1
?



Name: A Base EQ.gsz
Method: Spencer
Direction of movement: RightToLeft
Slip Surface Option: AutoSearch
Horz Seismic Load: 0.15
Vert Seismic Load: 0
Factor of Safety: 1.127
1.127
A
A'
ELEVATION (FEET)
700
650
600
550
500
EXISTING GRADE
Qsw
(NOT ON GEOLOGIC MAP)
Qudf
1.5:1 SLOPE
STRUCTURE
BELOW GRADE PARKING
Description: Kgu (weathered)
Model: MohrCoulomb
Wt: 130
Cohesion: 250
Phi: 34
Description: Kgu (unweathered)
Model: MohrCoulomb
Wt: 130
Cohesion: 350
Phi: 37
0
50
100
150
200
250
300
350
DISTANCE (FEET)
CROSS SECTION A-A'
HORIZONTAL=VERTICAL
GEOLOGIC CONTACT AFTER SEISMIC PROFILE STL 1
?



Name: A 01.gsz
Method: Spencer
Direction of movement: RightToLeft
Slip Surface Option: GridAndRadius
Horz Seismic Load: 0
Vert Seismic Load: 0
Factor of Safety: 1.768
A
A'
1.768
EXISTING GRADE
Qsw
(NOT ON GEOLOGIC MAP)
Qudf
1.5:1 SLOPE
STRUCTURE
BELOW GRADE PARKING
Description: Kgu (weathered)
Model: MohrCoulomb
Wt: 130
Cohesion: 250
Phi: 34
Description: Kgu (unweathered)
Model: MohrCoulomb
Wt: 130
Cohesion: 350
Phi: 37
ELEVATION (FEET)
700
650
600
550
500
0
50
100
150
200
250
300
350
DISTANCE (FEET)
CROSS SECTION A-A'
HORIZONTAL=VERTICAL
GEOLOGIC CONTACT AFTER SEISMIC PROFILE STL 1
?



Name: A 02.gsz
Method: Spencer
Direction of movement: RightToLeft
Slip Surface Option: GridAndRadius
Horz Seismic Load: 0
Vert Seismic Load: 0
Factor of Safety: 1.809
A
A'
1.809
EXISTING GRADE
Qsw
(NOT ON GEOLOGIC MAP)
Qudf
1.5:1 SLOPE
STRUCTURE
BELOW GRADE PARKING
Description: Kgu (weathered)
Model: MohrCoulomb
Wt: 130
Cohesion: 250
Phi: 34
Description: Kgu (unweathered)
Model: MohrCoulomb
Wt: 130
Cohesion: 350
Phi: 37
1
2
ELEVATION (FEET)
700
650
600
550
500
0
50
100
150
200
250
300
350
DISTANCE (FEET)
CROSS SECTION A-A'
HORIZONTAL=VERTICAL
GEOLOGIC CONTACT AFTER SEISMIC PROFILE STL 1
?

APPENDIX 6

GLOSSARY OF TERMS

GLOSSARY OF TERMS

CTE	Construction Testing and Engineering, Inc.
EIR	Environmental Impact Report
SEIR	Supplemental Environmental Impact Report
Southwest	Southwest Geophysics, Inc.

APPENDIX E

RIPPABILITY INFORMATION, CHEMICAL ROCK SPLITTING INFORMATION, AND SAN DIEGO COUNTY BLASTING REGULATIONS

Table 3C-2. Estimated Ripping Production Using Seismic Velocity Charts

Equipment Used to Rip	Earth Material	Rippable Shear Wave Velocity (ft per sec)	Marginally Rippable Shear Wave Velocity (ft per sec)	Non-Rippable Shear Wave Velocity (ft per sec)
D8R Multi or Single Shank	Granite	0 to 5,800	5,800 to 8,000	Above 8,000
D9R Multi or Single Shank	Granite	0 to 6,800	6,800 to 8,000	Above 8,000
D10R Multi or Single Shank	Granite	0 to 7,200	7,200 to 8,200	Above 8,200
D11R Multi Shank	Granite	0 to 8,100	8,100 to 9,500	Above 9,500
D11R Single Shank	Granite	0 to 8,400	8,400 to 9,900	Above 9,900

Note: The following table summarizes data presented within the Caterpillar® Performance Handbook, Edition 31, published October 2000, by Caterpillar, Inc. The table represents ripper performance estimated by seismic wave velocities and may help in determining the effectiveness of dozer ripping bedrock materials. Caterpillar, Inc. states that considering the extreme variations among materials and even among rocks of a specific classification, the charts must be recognized, at best, as being only one indicator of material rippability.

Source: Catapillar, Inc. 2000

BRISTAR

1. WHAT IS BRISTAR?

BRISTAR is a soundless and safe demolition agent which is quite different from ordinary demolition agents such as explosives and dangerous materials. It does not cause any flyrock, noise, ground vibration, gas, dust or any other environmental pollution when used properly.

As requirements for demolishing rock and reinforced concrete in construction increase in tight quarters, the use of explosives and explosive agents is becoming more restricted as far as safety and environmental pollution problems are concerned. **BRISTAR** is the solution.

When **BRISTAR** is mixed with an appropriate quantity of waster and poured into cylindrical holes drilled in rock or concrete, it hardens and expands. **BRISTAR** cracks the matter to be demolished which then can be easily removed with a pick breaker, pneumatic breaker, excavator, etc.

There are currently 4 grades of **BRISTAR** on the market designed for various temperature ranges (shown in Fig. 1) of material to be cracked. Since a chemical reaction of **BRISTAR** depends on temperature, use the proper type of **BRISTAR** listed in Table 1.

Table I. BRISTAR designed for various range of temperature

TEMPERATURE RANGES		
Product	Material Temp. Range	Mixing Water Temp.
Bristar 100	69 to 95 F	59°
Bristar 150	50 to 68 F	59°
Bristar 200	32 to 59 F	50°
Bristar 300	23 to 41 F	41°

*B-100, and B-200 used in this brochure indicate BRISTAR 100, 150, 200, and 300, respectively.

2. ADVANTAGES OF BRISTAR

I. **BRISTAR IS A SAFE SUBSTANCE.**
BRISTAR is not controlled by any legal regulation such as explosives and explosvie agents, etc. Qualified persons are not required for handling. Demolition can be easily and safely performed anywhere.

II. **BRISTAR IS A SOUNDLESS CRACKING AGENT.**
Unlike the existing methods of demolition, **BRISTAR** does not make any noise, vibration, flyrock, dust or gas. Rocks and reinforced concrete may be demolished safely without environmental pollution. Furthermore, **BRISTAR'S** expansive stress continues even after crack initiation, the crack opening distance becomes wider as time passes.

III. **BRISTAR HANDLES EASILY.**
No lid (or cap) is necessary after **BRISTAR** is poured into a hole of rock or reinforced concrete, nor is tamping required as with explosives. **BRISTAR** exerts its strength in a short time. Due to **BRISTAR'S** strong adhesion and frictional resistance to inner surface of the hole, spurs due to heat-generation (blown-out shot) do not occur when used within the parameters as noted in the conditions. The expansive stress along the hole depth is almost constant except for that near the entrance of the hole. Generally the expansive stress loss from the hole entrance has little effect on the demolition work when hole depth is long.

IV. **BRISTAR HAS AN EXPANSIVE STRESS OF MORE THAN 6000 t/m² (fig. 2,3,4)**
Generally, the compressive fracture stress of rocks is 1000 to 2000 kg/cm² and that of concrete 150 to 500 kg/cm². However, the tensile fracture stress is very small, i.e., it ranges from 40 to 70 kg/cm² in concrete, respectively. Since demolition by using **BRISTAR** is based on a fracture due to a tensile stress, all kinds of rocks and concrete can be cracked and broken by using **BRISTAR** when appropriate holes are properly drilled.

3. PROPERTIES OF BRISTAR

I. CHEMICAL COMPONENTS OF BRISTAR
BRISTAR is a powder consisting of an inorganic compound made mainly of a special kind of silicate and an organic compound. **BRISTAR** does not contain any harmful components.

II. SOME EFFECTS ON THE EXPANSIVE STRESS OF BRISTAR
1) The expansive stress increases more than 6,000t/m². (Fig. 1, 3, 4)
2) The larger the hole diameter is, the greater the expansive stress becomes. (Fig. 2)
3) There is little change in the expansive stress when the water ratio is in the neighborhood of approximately 30%. However, the stress is decreased as the water ratio is increased or decreased.

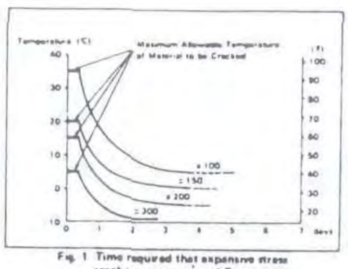


Fig. 1 Time required that expansive stress reaches 6000 t/m² and Temperature

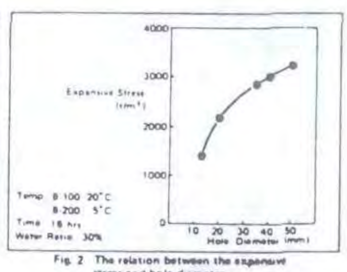


Fig. 2 The relation between the expansive stress and hole diameter.

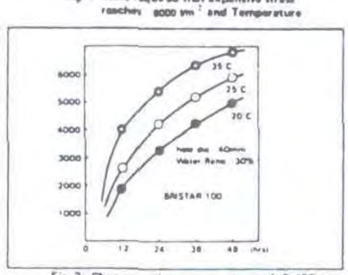


Fig. 3 Changes in the expansive stress of B-100

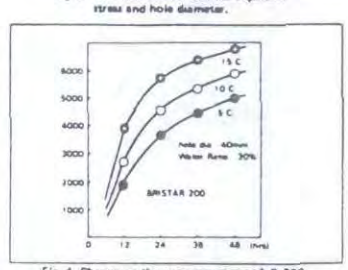


Fig. 4 Changes in the expansive stress of B-200

4. FRACTURE MECHANISM

After **BRISTAR** is poured into holes drilled in rocks or concrete, the expansive stress gradually increases with time, and reaches to more than 6000 t/m² at room temperature after 24 hours. As the **BRISTAR** generates its expansive stress, the material to be cracked undergoes a process of (1) crack initiation, (2) crack propagation, (3) the increase of crack width. Therefore, this fracture mechanism is distinguished from a breakage by blasting.

The mechanism by the expansive stress of **BRISTAR** is shown in Fig. 5. Cracks initiate from an inner surface of the hole, being caused by tensile stress at a right angle with the compressive stress which occurs by the expansive stress of **BRISTAR**. The expansive stress of **BRISTAR** continues even after the appearance of cracks, the cracks propagate and also new cracks initiate during the process. Usually, for a single hole, 2-4 cracks initiate and propagate. When a free surface exists, the crack, as shown in Fig. 6, is pushed apart mainly by the shear stress, and a secondary crack also arises from the bottom of the hole running toward the free surface.

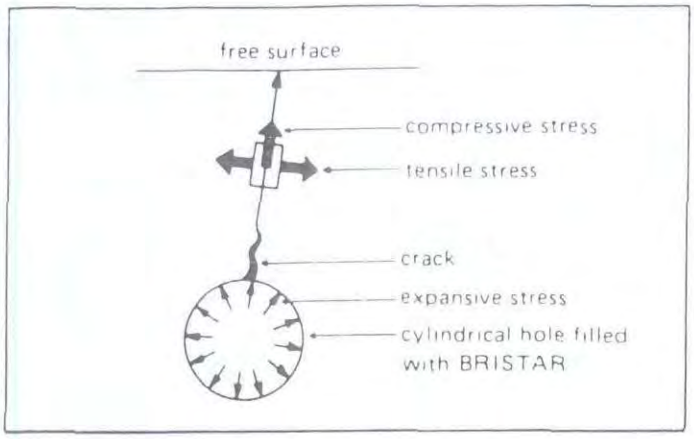


Fig. 5 Fracture mechanism by the expansive stress of BRISTAR

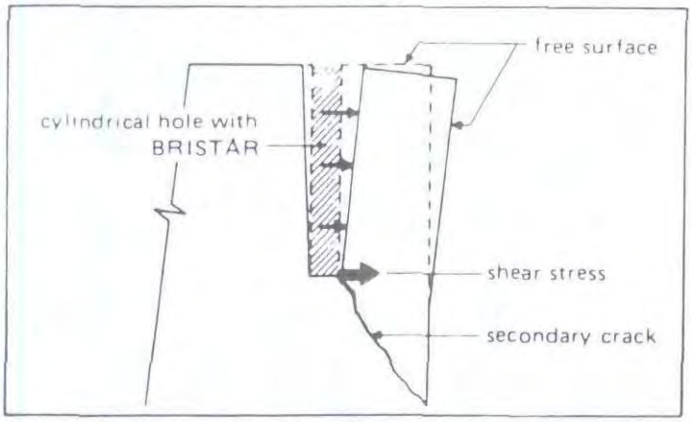


Fig. 6 Sectional-view of the crack formation in the material with two free surfaces

When multiple numbers of holes are filled with **BRISTAR**, that are properly adjacent to each other, the cracks from the hole propagate to connect with the neighboring holes, as shown in Fig. 7.

It is therefore possible to determine the directions of the cracks as planned by appropriately arranging the hole spacing and its depth and its inclination.

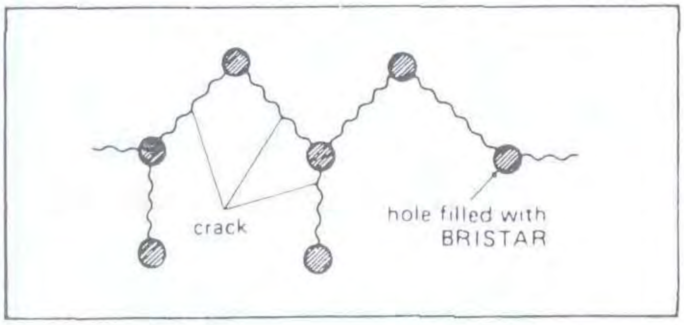


Fig. 7 Crack propagation

Establishment of free surface

In the case of trenching, shafting or tunneling, if all holes are drilled vertically and filled with **BRISTAR**, the crack width can not increase but horizontal cracks initiate. Therefore, in order to obtain two free surfaces, inclinated holes or pre-splitting must be required. (Refer to APPENDIX)

5. TEST BREAK AND DRILLING

BRISTAR'S effectiveness, therefore, depends on the placement of the holes. The drilling must be done in relation to the job to be performed.

5.1 Test design and breaking

The design for breaking should be done according to the properties of rocks, joint, volume to be removed, secondary breaking, and work period, etc. Table III should be taken into account for the design.

Prior to the execution of test break, reference should be made to APPENDIX to assist in break design.

To determine which combination of hole size and spacing is most desirable, drill several holes of different diameter at different burden and spacing, check each of the break conditions and then decide hole diameter, depth, burden and spacing.

Table III Type of Breaking by BRISTAR

Type	Secondary breaking
Fragmentation	Hammer, Power shovel
Crack formation	Hand breaker, Power shovel, Hydraulic breaker
Presplitting	Combination of mechanical breaker or dynamite

5.2 Drilling

I	Drilling machine	Use electrical drill, rock drill or crawler drill.
II	Drilling direction	It is preferable to drill holes vertically, but in cases of a wall or pillar of reinforced concrete where vertical drilling is hard, an inclined hole may be drilled. Since a greater effect is achieved with a deeper hole, in case of a thin material, consideration should be given so as to get a long hole depth by drilling it obliquely if necessary. Horizontal holes can be applied the same idea of spacing as with vertical holes.
III	Hole Diameter and hole spacing	The breaking plan of Table IV can serve as a guidance in making a decision. In general, the preferable hole diameter is from 40 to 50 mm (1½" x 2").

Table IV. Material and proper hole spacing

material to be crakced \ hole spacing		cm: 20 40 60 80 100 / feet: 1 2 3
hard virgin rocks		⟷
soft virgin rocks		⟷
presplitting of the above rocks		⟷
Reinforced concrete	foundation, pillar, beam	⟷
	wall, slab	⟷

IV Hole depth: This varies with the shape of the material to be cracked or the break plan. Refer to APPENDIX as a guide line.

It should be noted that **BRISTAR** mixed with water can easily be applied by hand, when the hole depth is up to approximately 10 meters. When the depth is less than 3 times the diameter of the hole, less cracking will occur, the breaking effect is lessened and the time required for demolition is increased.

5.3 Use of thin steel pipe

In the case of a temporary concrete structure (to be demolished), place thin steel pipes (the thickness: 0.8mm (1/32") i.e. a sheath pipe for P.S. concrete) as holes before placing concrete instead of drilling. Whenever the structure needs to be cracked, fill **BRISTAR** in the pipes. There is no change in breaking effect by the use of pipe.

6. MIXING AND FILLING

6.1 Mixing of **BRISTAR**

I. Mixing Equipment:

Mix one bag (5 kg, 11 lb) of **BRISTAR** with water at a time by hand or preferably with a mechanical mixer. Prepare the following equipments.

(1) Container: For one bag of **BRISTAR** - a metal bucket or clean can of 10-20 liters capacity.

(2) Mixer: For instance, hand-mixer

(3) Water meter: Breaker or measuring cylinder.

(4) Protector: Rubber gloves, safety goggles.

II Mixing Method

Pour approximately 1.5 liter (0.4 U.S. gallon) of water into container. Add one bag of **BRISTAR** gradually and mix well until it has a good fluidity.

When a viscosity of the mixture of **BRISTAR** and water is too high to pour into the hole, add a little water to get a good fluidity. Do not exceed 34% of water ratio (1.7 liter; 0.45 U.S. gallon per 5 kg; 11 lb. of **BRISTAR**). The mixing time by hand-mixer is about 2-3 minutes (it is recommended that mechanical mixer be used on large volume jobs). When mixing by hands, wear rubber gloves.

III. Mixing Water

Refer to chart found on page one. Use clean water.

IV Standard Quantity

The quantity of **BRISTAR** to be used for cracking differs with the hole spaces and diameters. In Table V, the relation between the quantity of **BRISTAR** used and the hole diameters is indicated for the hole of 1 m depth, where **BRISTAR** was mixed at a water ratio of 30%.

Table V. Quantity of **BRISTAR** used per hole depth and the hole diameters.

Hole Diameter	(mm)	36	38	40	42	44	46	48	50
BRISTAR	(kg/m)	1.7	1.9	2.1	2.3	2.5	2.8	3.0	3.2

Hole Diameter	(inch)	1 3/8	1 1/2	1 5/8	1 3/4	1 7/8	2
BRISTAR	(Lb/yd)	3.1	3.7	4.4	5.1	5.8	6.7

6.2 Filling of the hole with **BRISTAR**

I. **BRISTAR** should be poured into holes within 10 minutes after mixing with water. **BRISTAR** may set up within 10 minutes loosing its fluid properties and becoming difficult to poor. Once its fluidity is gone, it should not be diluted by re-mixing with water, as the strength is greatly reduced.

II **BRISTAR** is best placed using a bucket with pour spout, coking gun or grouting pump, especially for a horizontal hole. Try to drill horizontal holes with some slope to help in filling.

III. **BRISTAR** must be poured into a hole to the brim.

IV For a horizontal hole, the hole can be easily plugged with **BRISTAR** as it reaches a clay like consistancy as it starts setting up. A slight slope makes their use much easier.

The average quantity of **BRISTAR** used per 1 m^3 is 5kg for the material to be broken when working at in virgin rock (8,4 lb/yd^3). For fragmentation and reinforced concrete, an amount of 2 to 4 times of that is required. Design the hole diameter and the spacing by also referring to Table IV or APPENDIX.

6.3 Use of polyethylene sack in hole

I. If there is water in the hole, place polyethylene thin sack equal to the hole diameter into the hole, insert a wooden rod into the bag and then fill **BRISTAR** into the sack. (See Fig. 8) The **BRISTAR** in the sack will displace the water in the hole. There is no change in the breaking effect by the use of this kind of sack.

II. When there are many joints or large voids in the material to be cracked or when **BRISTAR** somewhat leaks from the hole, use the sack.

III When much water of the slurry is absorbed to the material to be cracked (for instance, a dry concrete), use the sack or spray water into the hole. In cold temperature, avoid the water sprayed freezing in the hole.

IV When the material to be cracked is in water, use the sack indicated in Fig. 8. Try to use the bucket or the pump when filling into the pipe, remove it up, and then tie the sack to avoid **BRISTAR** filled diluting. If there is no flow of water around an entrance of the hole, **BRISTAR** may directly be poured into the hole using the pump so on. It should gently displace the water in the hole.

6.4 After Treatment

I. Tamping with mortar or sand is not required at all after the filling of **BRISTAR**. It is also not necessary to put on any restrictive cap. Just leave as it is and wait until crack initiates. Covering the filled hole with a plastic cover is desirable to avoid dilution of **BRISTAR** from external water source until cracking starts.

II Spraying the surface with water after the cracks initiate tends to increase the width of cracks and speed the cracking process.

7. TIME REQUIRED FOR CRACK FORMATION

The time required for crack formation in material at 20°C (68°F) is about 10-20 hours. The lower the temperature the longer crack formation takes. The crack width for rock continues to increase with time and can become 10-30mm (3/8" - 1 1/8") after several days, depending on free surfaces available. It is best to wait until the **BRISTAR** has worked to full depth before removing rock as premature removal at the first sign of a crack can hamper the leverage effect of **BRISTAR**

8. CONTAINER AND STORAGE

BRISTAR is packed in 4 anti-moisture bags of 5 kg (11 lb.) each and then placed in a water proofed carton with a total weight of approximately 20 kg (44 lb.).

I. Although **BRISTAR** is packed in anti-mositure paper bags, long storage may cause deterioration of its working ingredients. Therefore, store in a dry place and use it as soon as possible.

II. When storing, do not place the bags of **BRISTAR** directly on floor, put them on a pallet and keep in a dry warehouse etc. **BRISTAR**, stored in this manner, can be effectively used for about 1 year.

III. **BRISTAR** should be unpacked before use.

IV. When storing the portion of **BRISTAR** remaining after use, push the air out of the bag, then seal with gum tape and use as soon as possible. However, as it may get exposed to moisture there is risk of **BRISTAR** losing its effectiveness once the bag has been opened.

V. If you receive broken bags of **BRISTAR**, they may not work due to chance of moisture absorption.

9. CAUTION

I. **Do not use BRISTAR** for other purposes besides the cracking of rocks or concrete as instructed in this brochure.

II. **Rinse with water,** any portion of the skin that comes *in contact with* BRISTAR.

III. When mixing and filling **BRISTAR** in holes, **wear rubber gloves and safety goggles.**

IV. **Do not pour and leave BRISTAR** in bottle or can to avoid shattering of the can or bottle.

V. **Do not look directly into any holes for at least 6 hours** after pouring. **BRISTAR** may splatter or blow out of the hole due to heat generation when temperature of material to be broken is over temperatures in chart found on page one.

VI. **Do not use hot water.** Refer to chart found on page one.

PRECAUTION

In details, refer to CAUTION on Sec. 10 before using BRISTAR.

- Do not use BRISTAR for other purposes *besides the cracking* of material.
- Do not pour and leave BRISTAR in bottle or can.
- Do not look directly into any holes for at least 6 hours after filling.
- Use the proper type of BRISTAR listed in Table 1 (P.1).
- Do not use hot water.
- Wear rubber gloves and safety goggles when mixing and filling.
- Rinse with water when any portion of the skin comes in contact with BRISTAR.

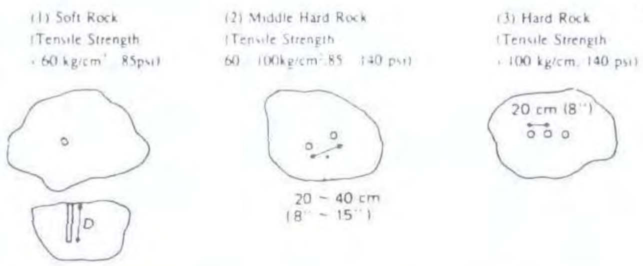
APPENDIX
"Hole Design for Rock"

d Hole Diameter
L Hole Space
D Hole Depth

θ Angle
→ Hole Direction

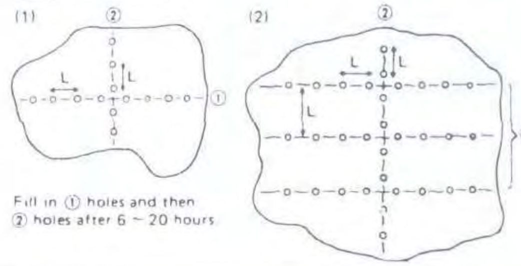
1 General Concept for Boulder (1 - 1.5m^3;1.5 - yd^3)

d	38 - 44 mm
	1½" - 1¾"
D	70% of Height



2 Splitting of Large Boulder

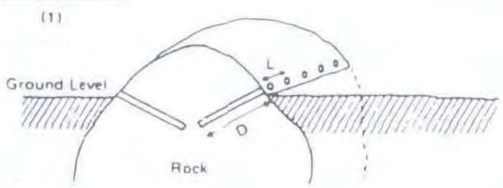
d	32 - 35 mm	44 - 51 mm
	1¼" - 1⅜"	1¾" - 2"
L	30 - 40 cm	60 - 90 cm
	1' - 1'4"	2' - 3'
D	70% of Height	



3 Underground Excavation

d	38 - 44 mm
	1½" - 1¾"
L	30 - 60 cm
	1' - 2'
D	Shown in Figure

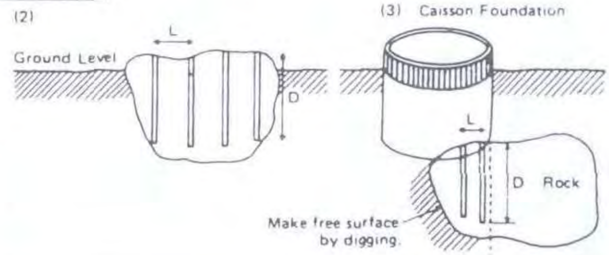
(1)



d	38 - 51 mm
	1½" - 2"
L	60 - 90 cm
	2' - 3'
D	90% of Height

(2)

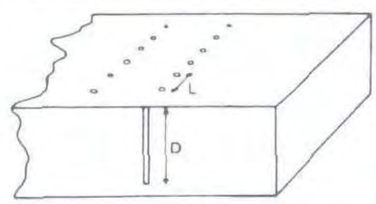
(3) Caisson Foundation



4 Slabbing

d	32 - 35 mm	44 - 51 mm
	1¼" - 1⅜"	1¾" - 2"
L	20 - 30 cm	40 - 50 cm
	8" - 1'	1'4" - 1'8"
D	90% of Height	

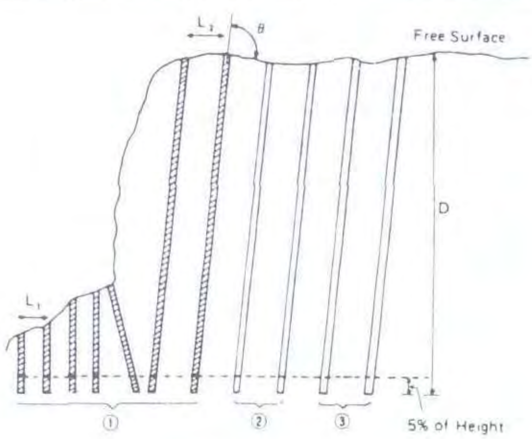
Small d and L should be used to obtain a straight crack line



5 Leakage of Virgin Rock

d	44 - 51 mm
	1¾" - 2"
L	30 - 40 cm
	1' - 1'4"
L	60 - 90 cm
	2' - 3'
D	Adding 5% of Height
θ	80 - 90°

The toe should be drilled at closer hole spacing and successively broken from the front row No drilling will cause poor breakage

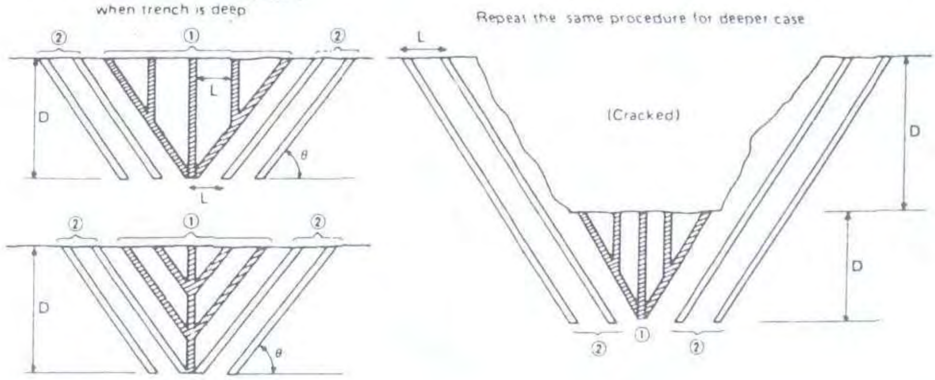


The front holes (up to sixth row) may be simultaneously filled in. It is more effective for the removal to fill in 1 holes and then each two rows (2 3) after a delay of 6 - 20 hours

6 Trenching and Tunneling

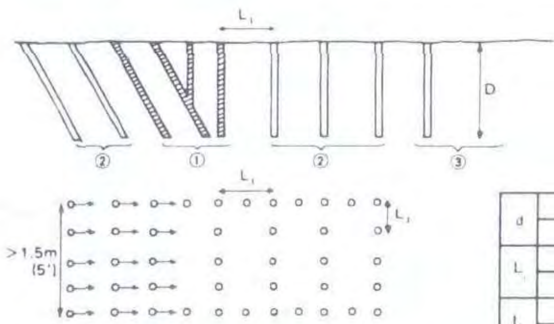
(1) V-cut

d	38 - 51 mm
	1½" - 2"
L	30 - 60 cm
	1' - 2'
D	1 - 1.8m
	3' - 6'
θ	45 - 60°



Fill in ① holes and then ② holes after delaying

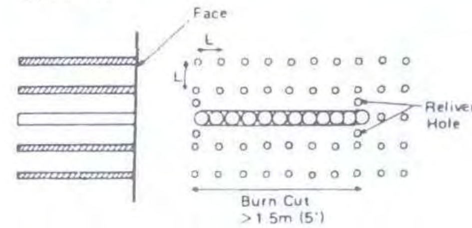
(2) V-cut



Fill in ① holes and then ② and ③ after delaying.

d	38 - 51 mm
	1½" - 2"
L	40 - 60 cm
	1'4" - 2'
L_1	30 - 40 cm
	1' - 1'4"
D	1 - 1.8 m
	3' - 6'

(3) Burn Cut



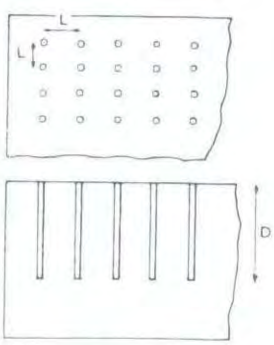
d	38 - 44 mm
	1½" - 1¾"
L	30 - 60 cm
	1' - 2'

For horizontal holes, drill them with some slope to help in filling

APPENDIX
"Hole Design for Concrete"

d Hole Diameter
L Hole Space
D Hole Depth
θ Angle
→ Hole Direction

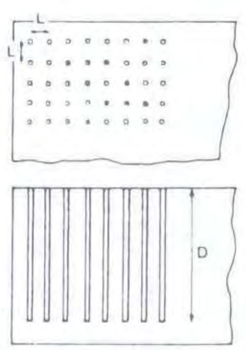
1 General Concept for Concrete



d	38 - 44 mm
	1½" - 1¾"
L	40 - 60 cm
	1'4" - 2'
D	70% of Height

When vertical drilling is difficult, drill horizontal holes with some slope

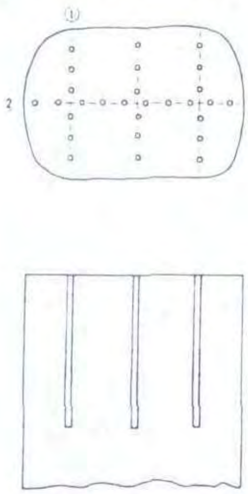
2 General Concept for Reinforced Concrete



d	35mm	38 - 44mm
	1⅜"	1½" - 1¾"
L	20 - 25 cm	30 - 40 cm
	8" - 10"	1' - 1'4"
D	90% of Height	

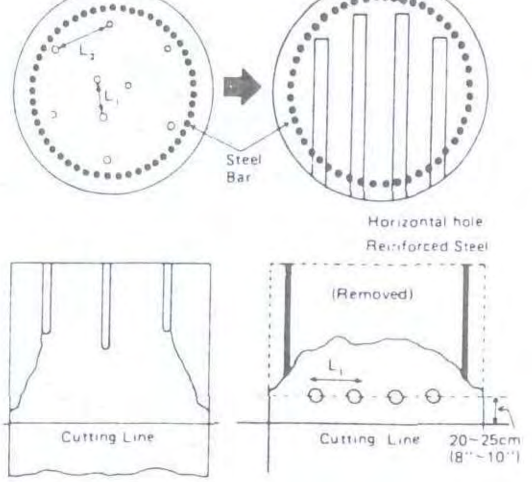
d and L depend on both quantity of reinforced steel and shape of that

3 Mass Concrete
(Bridge pier and Foundation etc.)



		Concrete	Reinforced concrete
d		38 - 51mm	38 - 44mm
		1½" - 2"	1½" - 1¾"
L		50 - 90cm	40 - 60cm
		1'8" - 3'	1'4" - 2'

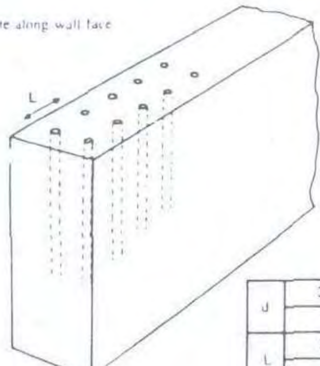
4 Pile Foundation



d	38 - 44 mm
	1½" - 1¾"
l	20 cm
	8"
L	20 - 25 cm
	8" - 10"

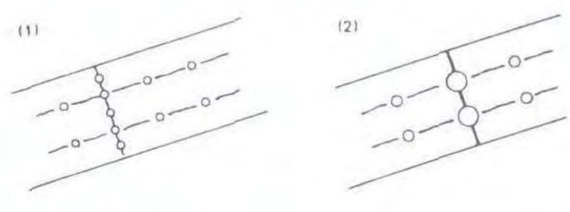
5 Thick Wall

Cracks propagate along wall face



d	38 - 44 mm
	1½" - 1¾"
L	30 - 60 cm
	1' - 2'

When perpendicular cracks to wall face are necessary

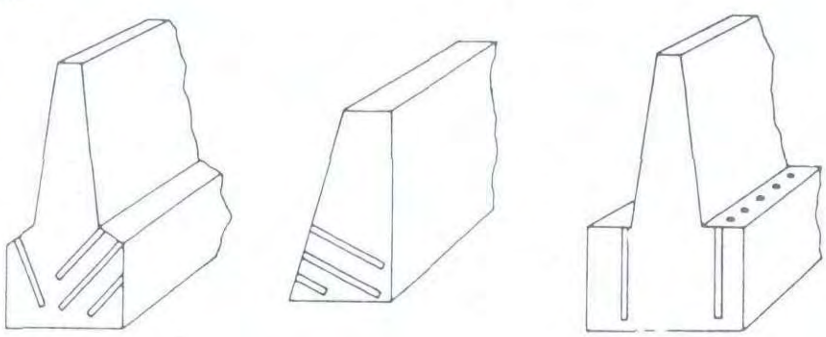


Add a reliever hole
Spacing may be 10cm (4")
though 20cm (8")

Drill larger d of holes

6 Pier, Bridge Foundation, Retaining Wall

Drilling depends on a shape of structure
and a circumstance

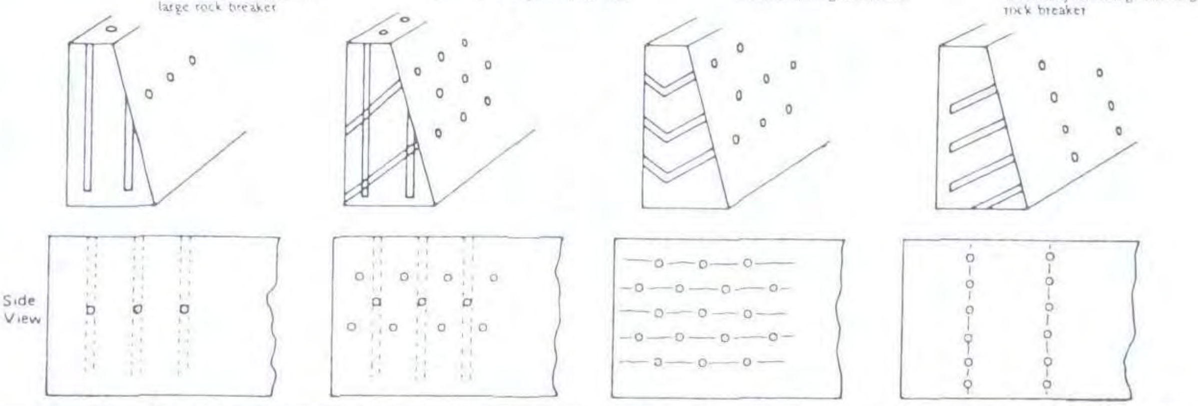


(1) Making of large block, Secondary breaking with large rock breaker

(2) Making of small pieces, Drilling is only from one side

(3) Wall is very high, Vertical drilling is difficult

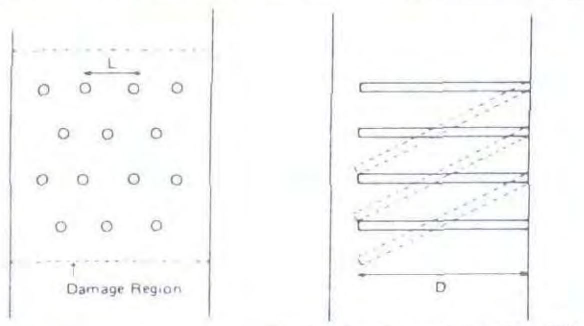
(4) Foundation is thick, Secondary breaking with large rock breaker



7 Zone Demolishing (Pillar, Beam, Wall)

(1) Stagged Arrangement (Pillar)

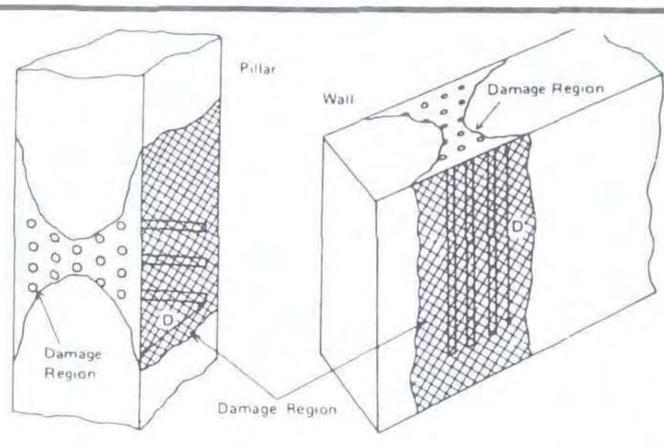
d	38 - 44 mm
	1½" - 1¾"
L	30 - 40 cm
	1' - 1'4"
D	90% of Width or Height



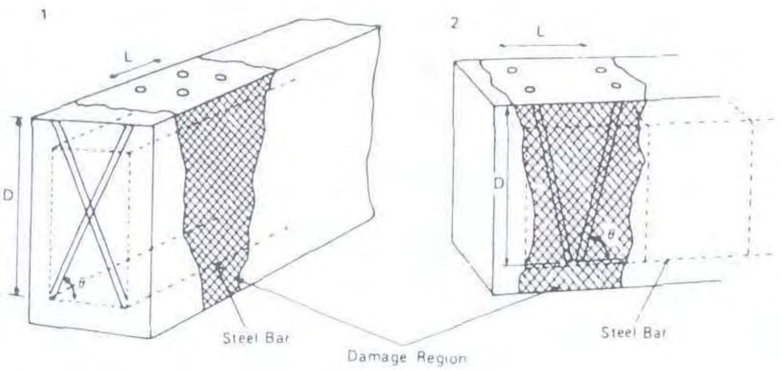
Horizontal or Inclinated Hole (60 ~ 80°)

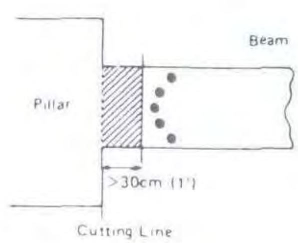
(2) X Figure Arrangement (Pillar, Wall)

d	38 - 44 mm
	1½" - 1¾"
L	30 - 40 cm
	1' - 1'4"
D	90% of Width or Height



(3) Cross Drilling (Beam)





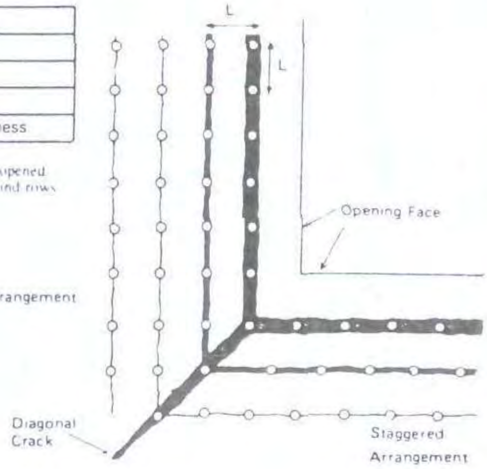
Try to set safety zone to avoid pillar cracking

d	38 - 44 mm
	1½" - 1¾"
L	30 - 40 cm
	1' - 1'4"
D	90% of Width or Height
θ	60 - 80°

8 General Concept for Thin Concrete (Wall, Slab)

d	32 - 38 mm
	1¼" - 1½"
L	25 - 30 cm
	10" - 1'
D	Around Wall Thickness

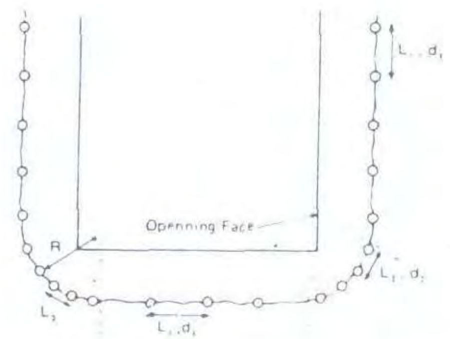
Crack width of the front row is opened much larger than that of the behind rows



2) Avoid diagonal crack

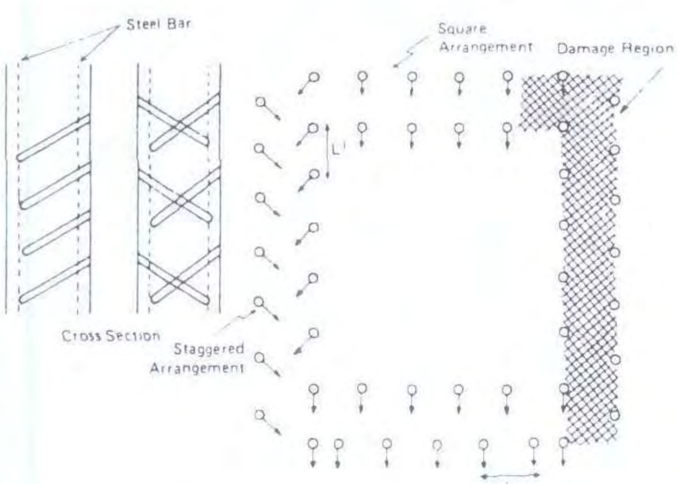
d	32 - 38 mm		25mm	32 - 38mm
	1¼" - 1½"		1"	1¼" - 1½"
L	25 - 30cm		10cm	10 - 15cm
	10" - 1'		4"	4" - 6"

The curvature at corner (R) should be more than 15cm (6")



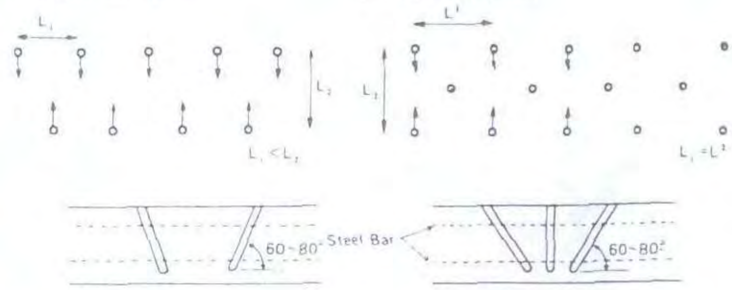
3) Splitting of Wall

d	38 - 44 mm
	1¼" - 1½"
L	25 - 30 cm
	10" - 1'



4) Splitting of Slab

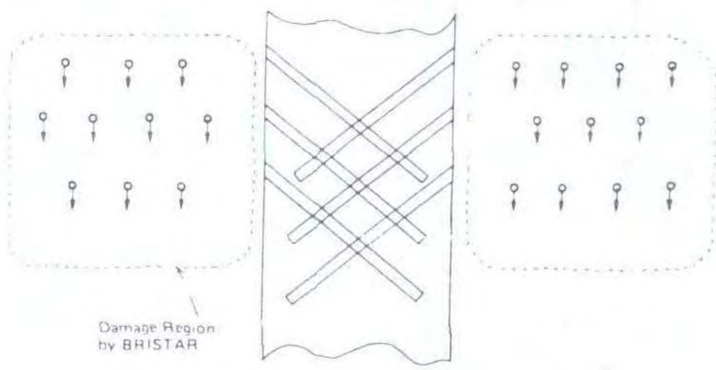
d	38 - 44 mm
	1½" - 1¾"
L	25 - 30 cm
	10" - 1'



5) Establishment of free surface

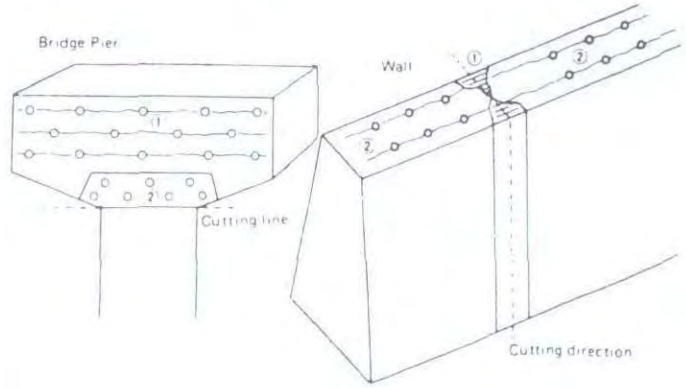
In stead of Burn Cut (chapter 6 of Rock), cross drilling may be used to establish the free surface for wall case

d	38 - 44 mm
	1¼" - 1½"
L	20 - 25 cm
	8" - 10"



9 Delay filling

Fill in (1) holes then (2) holes after delaying (See 2. 6 of Rock, and 3 of Concrete.) This can be applied for controlling of a crack direction



DTI Demolition Technologies Incorporated

Right Grade, Right Results

Always start by matching the temperature of the material to be cracked with the temperature range of BRISTAR & SUPER BRISTAR 2000. Also, match the temperature of the water with the grade of BRISTAR & SUPER BRISTAR 2000 you are mixing.

Item	Grade	Temp Of The Material	Temp Of The Water
SUPER BRISTAR 2000	H	77°-95°F	below 77°F
SUPER BRISTAR 2000	M	59°-86°F	below 68°F
SUPER BRISTAR 2000	L	41°-59°F	below 59°F
BRISTAR	100	59°-95°F	below 59°F
BRISTAR	150	50°-68°F	below 59°F
BRISTAR	200	41°-59°F	below 50°F
BRISTAR	300	23°-41°F	below 41°F

MIXING

	Mixing Water	Mixing Time	How to Mix	Pouring Time	How to Pour	Cracking Time
SUPER BRISTAR 2000	1 liter	20 sec.	Add cool, clean water to a clean **shallow pan**. Mix in 1 bag of SUPER BRISTAR 2000. Mix 1 bag at a time.	Within 2 minutes	Mixture is stiff. Move a rod up/down lightly while pouring and remove gradually. Fill hole to the brim.	40 minutes - 3 hours
BRISTAR	1.5 liters	2-3 minutes	Add cool, clean water to a clean **bucket.** Mix in 1 bag of BRISTAR. Several bags can be mixed at a time.	Within 5 minutes	The slurry is easy to pour. Fill hole to the brim.	10-20 hours

YIELD BY BAG

Designing hole patterns is an art we practice everyday. We will be happy to design yours. And once you've got a hole pattern, it's simple to figure out how much BRISTAR you need. The formula: LB/FT x Number of Holes x Depth of Holes ÷ 44 (lbs).

Hole Diameter		1 1/2"	1 5/8"	1 3/4"	1 7/8"	2"
SUPER BRISTAR 2000	(lb/ft)	no	1.8	2	2.2	no
	(ft/bag)	no	6.1	5.4	4.9	no
BRISTAR	(lb/ft)	1.3	1.5	1.8	2	2.4
	(ft/bag)	8.5	7.2	6.2	5.5	4.5

Note: The chart shows how many drilled feet one 11 lb. bag of BRISTAR yields. There are four 11 lb. bags per case. You may get 3% to 6% less due to field conditions like spilling and actual hole size.

Material Safety Data Sheet

IDENTITY (As Used on Label and List) BRISTAR	Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name ONODA CORPORATION	Emergency Telephone Number 03-5683-2026 JAPAN
Address (Number, Street, City, State, and ZIP Code)	Telephone Number for Information 03-3285-9268 JAPAN
NO. 1-13, TOYO 4-CHOME, KOTO-KU,	Date Prepared FEBRUARY 23, 2000
TOKYO 135, JAPAN	Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))		OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
A. HAZARDOUS COMPONENTS : None					
B. NON-HAZARDOUS CHEMICAL COMPONENTS (% by weight)					
1. Inorganic Compounds					
1) Silicon Dioxide	(SiO_2)	2 - 11 %			
2) Aluminium Oxide	(Al_2O_3)	0.3 - 6 %			
3) Ferric Oxide	(Fe_2O_3)	0.5 - 3 %			
4) Calcium Oxide	(CaO)	77 - 96 %			
5) Magnesium Oxide	(MgO)	0 - 2 %			
6) Sulfur Trioxide	(SO_3)	0.5 - 5 %			
2. Organic Compound					
Sulfonated melamine (CAS No.64787-97-9) or naphthalene-sulfonic acid polymer with formaldehyde, Sodium salt (CAS No.9084-06-4) ··· Approx. 1 %					

Section III — Physical/Chemical Characteristics

Boiling Point	Not Applicable	Specific Gravity (H_2O = 1)	3.21
Vapor Pressure (mm Hg.)	Not Applicable	Melting Point	1200°C
Vapor Density (AIR = 1)	Not Applicable	Evaporation Rate (Butyl Acetate = 1)	Not Applicable
Solubility in Water: Slight			
Appearance and Odor: Gray powder, No odor			

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used): Not Applicable	Flammable Limits: Not Applicable	LEL -	UEL -

Extinguishing Media: Not Applicable

Special Fire Fighting Procedures: Not Applicable

Unusual Fire and Explosion Hazards: When the product is used incorrectly such as the use out of proper temperature range etc., blown-out shots will occur.

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	X	

Incompatibility (*Materials to Avoid*) Water (Only storage)

Hazardous Decomposition or Byproducts NONE

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	

Section VI — Health Hazard Data

EYE CONTACT : Avoid

Route(s) of Entry:	Inhalation? Avoid	Skin? Avoid	Ingestion? Avoid

Health Hazards (*Acute and Chronic*) 1) Skin and eye contact : Irritation, Burn

2) Inhalation and Ingestion : The same symptoms as getting cement or quicklime will appear.

Carcinogenicity:	NTP? Not Applicable	IARC Monographs? Not Applicable	OSHA Regulated? Not Applicable

Signs and Symptoms of Exposure

Since the product is an alkali material, skin etc. will be irritated.

Medical Conditions Generally Aggravated by Exposure

Skin and eyes will be irritated and will be got burn unless immediately rinsed off.

Emergency and First Aid Procedures
If the skin comes in contact with the product, rinse it off with clean water immediately.
If eyes come in contact with it, rinse it off with much clean water immediately, and *

Section VII — Precautions for Safe Handling and Use

* consult with a doctor as soon as possible.

Steps to Be Taken in Case Material Is Released or Spilled
1) Gather the released or spilled product with a broom or a shovel.
2) Mix it with a large amount of water.
3) Sprinkle it onto open ground.

Waste Disposal Method
1) Mix it with a large amount of water.
2) Sprinkle it onto open ground.

Precautions to Be Taken in Handling and Storing Store it under dry condition, and wear safety goggles for eye protection, and use rubber gloves.

Other Precautions When mixing the product with water, do not get close to holes filled with the mixture of the product and water to avoid any accident to be caused by blown-out shots.

Section VIII — Control Measures

Respiratory Protection (*Specify Type*) It is recommended to wear ordinary dust-proof mask.

Ventilation	Local Exhaust	Not Applicable	Special	Not Applicable
	Mechanical (*General*)	Not Applicable	Other	Not Applicable

Protective Gloves	Ordinary rubber gloves	Eye Protection	Safety goggles

Other Protective Clothing or Equipment Not Applicable

Work/Hygienic Practices Not Applicable

ORDINANCE NO. ________ (NEW SERIES)

AN ORDINANCE AMENDING DIVISION 5 OF TITLE 3
OF THE SAN DIEGO COUNTY CODE OF REGULATORY ORDINANCES
RELATING TO BLASTING OPERATIONS

The Board of Supervisors of the County of San Diego ordains as follows:

SECTION 1. Section 35.302 of the County Code is hereby amended to read as follows:

Sec. 35.302. ENFORCEMENT

The Uniform Fire Code, except for Articles 77 and 78, shall be enforced by the County Department of Planning and Land Use Codes Enforcement Division and which shall be operated under the supervision of the County Chief Fire Inspector. Articles 77 and 78 shall be enforced by the Sheriff of San Diego County and references in said Articles 77 and 78 to Chief shall mean the Sheriff of San Diego County.

SECTION 2. The following sections are hereby added to the County Code of Regulatory Ordinances:

Sec. 35.315.01 (77.101). Section 77.101 of the Uniform Fire Code is hereby revised to read as follows:

(a) This article shall apply to the manufacture, possession, storage, sale, transportation and use of explosives and blasting agents.

(b) This article as amended shall apply to any blasting operation unless the blast is determined to be a minor blast, in which case the inspection requirements of this amended article shall not apply. The Sheriff shall determine if the blast is minor. Persons conducting major blasting shall comply with all the requirements of this article as amended.

Sec. 35.315.02 (77.103). Section 77.103 of the Uniform Fire Code is hereby revised to read as follows:

(a) For definitions of BLASTING AGENT, BULLET RESISTANT, CHIEF, INHABITED BUILDING, EXPLOSIVES, GUNPOWDER, SPECIAL INDUSTRIAL EXPLOSIVE DEVICE, SPECIAL INDUSTRIAL HIGH-EXPLOSIVE MATERIAL and TEST BLASTING CAP NO. 8, see Article 9.

(b) APPROVED BLASTER means a blaster who has been approved by the Sheriff to conduct blasting operations and who has been placed on the list of approved blasters. Such listing shall be valid for a period of one (1) year unless revoked by the Sheriff.

(c) BLASTING OPERATION means the use of an explosive device or explosive material to destroy, modify, obliterate, or remove any obstruction of any kind.

(d) BLASTING PERMIT, for the purpose of this article, means a permit issued by the Sheriff or by the Chief Officer of the fire department serving the jurisdiction, pursuant to Article 77 of the Uniform Fire Code, and shall apply to a specific site. This permit shall be valid for a period not to exceed one (1) year.

(e) BLAST SITE means a geographically defined area where blasting may occur. It shall be shown on a project map or plot plan. Major blasting operations shall be conducted only within such defined areas. Distances for inspection and notification purposes shall be measured from all specific blast locations on a project site.

(f) EXPLOSIVES PERMIT, for the purpose of this article, means a permit issued by the Sheriff pursuant to Section 12000, et seq. of the California Health and Safety Code and Article 77 of the Uniform Fire Code. An explosives permit shall be valid for a period not to exceed one (1) year, as designated by the Sheriff, and may impose conditions on the permittee and his operations up to the point of actual use. In addition to this permit, a blasting permit is also required for the actual act of blasting.

(g) INSPECTOR means any private person acting on behalf of an approved blaster who has been approved by the Sheriff to conduct pre- and post-blast inspections in conjunction with blasting operations in the unincorporated areas of the County of San Diego, and who has been placed on the list of approved inspectors.

(h) MAJOR BLASTING means a blasting operation not qualifying as minor blasting.

(i) MINOR BLASTING means a blasting operation that meets all of the following criteria: quantity of rock to be blasted does not exceed ten (10) cubic yards per shot, bore holes do not exceed two inches (2"), hole depth does not exceed twelve feet (12'), maximum charge weight does not exceed scale-distance as shown below:

Distance from Blast Site (In Feet)	Scale-Distance Factor
0-300	Mandatory Seismic Monitoring
301-5,000	55
5,000+	65

(j) SHERIFF'S AUTHORIZED REPRESENTATIVE means the chief fire officer serving the jurisdiction.

Sec. 35.315.03 (77.104). Section 77.104 of the Uniform Fire Code is hereby revised by adding subparagraphs (f), (g), (h) and (i) as follows:

(f) Prior to the issuance of a Blasting permit, the chief, or his authorized representative, shall approve fire safety requirements and shall review the application for conformance to the requirements, as they relate to blasting operations, of the following permits when blasting is anticipated.

1. Building permit;

2. Grading permit;

3. All use permits;

4. Encroachment permits; and

5. Other entitlements to use property, including zoning requirements and any determination under The Zoning Ordinance of nonconforming status.

The applicant shall be responsible for notifying and obtaining all necessary approvals from the chief or his authorized representative.

(g) This article as amended shall apply to blasting and explosives permits issued on or after the effective date of this amendment. Permits issued prior to that date shall be subject only to such regulations as were in effect at the time the permit was issued.

(h) Blasters are required to comply with blasting regulations of neighboring jurisdictions, for any blasting operations outside of the unincorporated area of the County, but conducted in conjunction with projects within the unincorporated areas of the County of San Diego.

(i) The Sheriff, or his authorized representative, may impose conditions and procedures as are deemed reasonably necessary to protect the public health and safety based upon the peculiar and individual facts and circumstances of a particular blasting operation. The Sheriff, or his authorized representative, shall provide the blaster with the additional conditions or procedures in writing and the blaster shall comply with them until the blasting permit expires or the Sheriff, or his authorized representative, is satisfied they are no longer required and cancels the additional requirements.

Sec. 35.316.04 (77.105). Section 77.105 of the Uniform Fire Code is hereby amended to read as follows:

INSURANCE REQUIRED

Sec. 77.105. Before a blasting permit is issued, as required by Subsection (a) 3 of Section 77.104, the blaster shall submit a Certificate of Insurance evidencing that blaster has obtained, for the period covered by the permit, from a generally recognized responsible insurer, Commercial General Liability insurance written on an "occurrence" basis and in an amount of not less than five hundred thousand dollars ($500,000) each occurrence. The owner of the property upon which blasting operation is proposed shall file, or cause to be filed, a copy of the Certificate of Insurance (which states that blasting coverage is included) of the blaster with the Sheriff and the Chief of the Fire Protection District having jurisdiction.

The provisions of this Section 77.105 shall not apply to blasting operations by a property owner on the owner's own property which has a General Plan category of Rural Development Area.

Sec. 35.315.05 (77.301(a)). Section 77.301(a) of the Uniform Fire Code is hereby amended to read as follows:

Sec. 77.301. (a) Blasting shall only be permitted between the hours of 8:00 a.m. and 5:00 p.m or one-half (1/2) hour before Sunset whichever occurs first during any weekday, Monday through Friday, unless special circumstances warrant another time or day and special approval is granted by the Sheriff.

Sec. 35.315.06 (77.301). Section 77.301 is hereby amended by adding subparagraphs (n), (o) and (p) as follows:

(n) The owner shall give, or cause to be given a one-time, reasonable notice in writing for ongoing operations to all residences (including mobilehomes) and businesses within six hundred feet (600') of any potential major blast location, or three hundred feet (300') feet from any minor blast location. The notice shall be given promptly upon issuance of any building permit, grading permit, use permit, encroachment permit or other entitlement to use the property, including a determination under The Zoning Ordinance of nonconforming status.

(o) In addition to the notice given under Section 77.301(n), a notice by the blaster shall be given or cause to be given to the residences within six hundred feet (600') of a major blast site and three hundred feet (300') from a minor blast site, not less than twenty-four (24) hours nor more than one (1) week before blasting operations and shall be in a form approved by the Sheriff. The minimum 24 hour notice requirement may be reduced to a lesser period but not less than one hour if the Sheriff determines that special circumstances warrant such reduction in time.

(p) Adequate precautions shall be taken to reasonably safeguard persons and property before, during and after blasting operations. These precautions shall include:

1. The blaster shall cause an approved inspector to inspect all structures (including mobilehomes) within three hundred feet (300') of the blast site before blasting operations, unless inspection is waived by the owner and/or occupant. The inspector shall obtain permission of the owner and/or occupant before conducting the inspection. The inspection shall be only for the purpose of determining the existence of any visible or reasonably recognizable preexisting defects or damages in any structure. Waiver of inspection shall be in writing signed by the owner and/or occupant. Additionally, refusal to allow inspection shall constitute an automatic waiver, which shall be reported as such to the owner and/or occupant, and the fact of refusal shall be included in the summary report filed with the Sheriff (see Section 77.301.(o).2). The blaster shall cause an approved inspector to conduct post blast inspections upon receipt of a written complaint of property damage either by notice or knowledge of damage, providing damage is reported within one (1) year of the completion of blasting operations.

2. Complete pre-blast inspection reports identifying all findings and inspection waivers shall be signed by the inspector. Such inspection reports shall be retained by the blaster and upon a complaint of alleged damage the blaster shall cause a copy of the report to be immediately filed with the Sheriff. A copy shall also be sent to any individual who is directly involved in the complaint upon their request. Such inspection reports shall be retained by the blaster, and copies shall be immediately sent to the Sheriff and individuals directly involved in any alleged damage complaints at their request.

3. The blaster shall cause an approved inspector to conduct a post-blast inspection of all structures for which written complaints alleging blast damage have been received. A written report of such inspection shall be immediately filed with the Sheriff and delivered or sent to individuals directly involved in any alleged damage within sixty (60) days of receipt of a complaint.

4. The blaster shall permit Fire Protection District and Sheriff's Department personnel to inspect the blast site and blast materials or explosives at any reasonable time.

5. If a Fire Protection District or Sheriff's Department witness is desired by the blaster on areas of the property upon which blasting shall occur, arrangements shall be made at least twelve (12) hours prior to the blast. Confirmation shall be made to the Fire Protection District or Sheriff no less than one (1) hour prior to the blast. The witnessing department(s) may then assign a department member to be present and observe the blast at their discretion. Costs, if any, must be paid by the blaster and owner.

6. The blaster shall notify the Sheriff and the appropriate Fire Protection District, if any, on the day of a scheduled blasting operation not less than one (1) hour before blasting.

7. All major blasting operations shall be monitored by an approved seismograph located at the nearest structure within six hundred feet (600'). All daily seismograph reports shall be maintained by the blaster.

8. Confiscation: Any explosives which are illegally manufactured, sold, given away, delivered, stored, used, possessed, or transported shall be subject to immediate seizure by any Chief, issuing authority, or peace officer. The Sheriff shall be notified immediately upon any such seizure. When a blasting permit has been revoked or has expired and is not immediately renewed, any explosives are subject to immediate seizure.

Sec. 35.316.07 (77.307). Section 77.307 is hereby amended by adding subparagraphs (b), (c) and (d) as follows:

(a) The chief may seize, take, remove or cause to be removed at the expense of the owner all explosives, ammunition or blasting agents offered or exposed for sale, stored, possessed or transported in violation of this article.

(b) Any person violating or causing the violation of any of the provisions of this ordinance shall be guilty of a misdemeanor and upon conviction shall be punished by a fine of not more than $1,000.00 or by imprisonment in the County jail for six (6) months, or by both fine and imprisonment.

(c) It shall be unlawful and a violation of this ordinance for any person to provide false or misleading information or documentation to the County of San Diego or any of its officers or employees or to any jurisdiction having authority during any phase of the explosives or blasting permit process or blasting operations.

(d) In addition to the penalties provided in Paragraph (b) of this Section, any conditions caused or permitted to exist in violation of the provisions of this ordinance or in violation of the conditions of an explosives or blasting permit shall be deemed a public nuisance, and may be abated by the County as such or remedied in court in any manner provided by law.

Sec. 35.316.08 (77.308). The following Title and Section is hereby added to the County Code:

FEE STRUCTURE

Sec. 77.308. A blaster and inspector shall pay a fee to the Sheriff upon being designated an approved blaster or inspector. Fees shall also be charged for issuance of a blasting permit to conduct blasting operations. The amount of said fees shall be determined by the Sheriff on the basis of the full costs involved in processing said permits.

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APPROVED